CHAPTER 73

ENGINE FUEL AND CONTROL

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively.

Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary.



CHAPTER 73

ENGINE FUEL AND CONTROL

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CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
S.B.LIST		1	Aug 30/80				
S.B.LIST		2	Aug 30/80	73-00-00		1	May 30/80
S.B.LIST		3	Mar 31/99	73-00-00		2	Nov 30/75
S.B.LIST		4	Mar 31/99	73-00-00		3	Nov 30/80
S.B.LIST		5	Mar 31/99	73-00-00		4	Nov 30/77
S.B.LIST		6	Mar 31/99	73-00-00		5	May 30/80
S.B.LIST		7	Mar 31/99	73-00-00		6	May 30/80
S.B.LIST		8	Mar 31/99	73-00-00		7	May 30/80
S.B.LIST		9	Mar 31/99	73-00-00		301	May 30/82
S.B.LIST		10	Mar 31/99	73-00-00		302	Nov 30/75
S.B.LIST		11	Mar 31/99	73-00-00		303	Nov 30/75
S.B.LIST		12	Mar 31/99	73-00-00		304	Nov 30/75
S.B.LIST		13	Mar 31/99	73-00-00		305	Nov 30/75
S.B.LIST		14	Mar 31/99	73-00-00		306	May 30/82
S.B.LIST		15	Mar 31/99	73-00-00		501	May 30/77
S.B.LIST		16	Mar 31/99	73-00-00		502	May 30/77
S.B.LIST		17	Mar 31/99	73-00-00		503	May 30/77
S.B.LIST		18	Mar 31/99	73-00-00		504	May 30/77
S.B.LIST		19	Mar 31/99	73-00-00		505	May 30/77
S.B.LIST	R	20	May 31/03	73-00-00		506	May 30/77
S.B.LIST	R	21	May 31/03	73-00-00		507	Aug 30/77
S.B.LIST	N	22	May 31/03	73-00-00		508	Aug 30/77
				73-00-00		509	Aug 30/77
T. of C.		1	Mar 31/00	73-00-00		510	Aug 30/77
T. of C.	R	2	May 31/03	73-00-00		511	Aug 30/77
T. of C.	R	3	May 31/03	73-00-00		512	Aug 30/77
T. of C.		4	Mar 31/00	73-00-00		513	Aug 30/77
T. of C.		5	Mar 31/00	73-00-00		514	Aug 30/76
T. of C.		6	Mar 31/00	73-00-00		515	Aug 30/76
T. of C.		7	Mar 31/00	73-00-00		516	Aug 30/77
T. of C.		8	Mar 31/00	73-00-00		517	Aug 30/77
T. of C.		9	Mar 31/00	73-00-00		518	Feb 29/80
T. of C.	R	10	May 31/03	73-00-00		519	Aug 30/77
T. of C.		11	Mar 31/00	73-00-00		520	Aug 30/77
T. of C.		12	Mar 31/00	73-00-00		521	Aug 30/77
T. of C.		13	Mar 31/00	73-00-00		522	Aug 30/77
T. of C.		14	Mar 31/00	73-00-00		523	Aug 30/76
T. of C.		15	Mar 31/00	73-00-00		524	Aug 30/77

CH/SE/SU	C	PAGE	DATE
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73-00-00		531	May 30/79
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73-00-00		536	May 30/79
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73-09-01		401	Nov 30/77
73-10-00		1	May 30/78
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73-10-00		3	Feb 28/77
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73-11-01		403	Nov 30/79
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73-11-01		410	Nov 30/77
73-11-01	R	411	May 31/03
73-11-01		412	Nov 30/76
73-11-01	N	412 A	May 31/03
73-11-01	N	412 B	May 31/03
73-11-01		413	Mar 31/98
73-11-01		414	Nov 30/79
73-11-01		415	Nov 30/79
73-11-01		416	Nov 30/79
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73-11-01		601	Feb 28/81
73-11-01		602	Feb 28/81
73-11-02	R	401	May 31/03
73-11-02	D	402	
73-11-02	D	403	
73-11-02		501	Nov 30/75
73-11-03		401	Feb 28/77
73-11-03		402	Feb 28/77
73-11-03		403	Feb 28/77
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73-11-03	N	404 A	May 31/03
73-11-03	N	404 B	May 31/03
73-11-03		405	May 30/77
73-11-03		406	May 30/77
73-11-03		501	May 30/80
73-11-03		502	Nov 30/79

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
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73-11-03		507	Nov 30/78	73-12-02		503	Nov 30/79
73-11-03		508	Nov 30/78	73-12-02		504	Nov 30/79
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73-11-03		513	Nov 30/79	73-12-02		509	Nov 30/79
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73-11-03		516	Nov 30/79	73-12-02		512	Nov 30/79
73-11-03		517	Nov 30/79	73-12-02		513	Nov 30/79
				73-12-02		514	Nov 30/79
73-12-01		401	Feb 28/77	73-12-02		515	Aug 30/77
73-12-01		402	Feb 28/77	73-12-02		516	Nov 30/79
73-12-01		403	Nov 30/75	73-12-02		517	Nov 30/79
73-12-01	R	404	May 31/03	73-12-02		518	Nov 30/79
73-12-01	N	404 A	May 31/03	73-12-02		519	May 30/80
73-12-01	N	404 B	May 31/03	73-12-02		520	Nov 30/79
73-12-01		405	Feb 28/77	73-12-02		521	Nov 30/79
73-12-01		406	Feb 28/77	73-12-02		522	Nov 30/79
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73-12-01		502	Feb 28/77	73-12-03		402	Feb 28/77
73-12-01		503	Feb 28/77	73-12-03		403	Feb 28/78
73-12-01		504	Feb 28/77	73-12-03		404	Feb 28/78
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73-12-01		510	Feb 28/77	73-12-03		410	Feb 28/78
73-12-02		401	Feb 29/80	73-12-03		411	Feb 28/78
73-12-02		402	May 30/77	73-12-03		501	Feb 28/77
73-12-02		403	Aug 30/77	73-12-03		502	Feb 28/78
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73-12-02		406	Feb 28/77	73-12-05		402	Nov 30/75
73-12-02		407	Feb 28/77	73-12-05		403	Nov 30/75
73-12-02		408	Feb 28/77	73-12-05	R	404	May 31/03
73-12-02	R	409	May 31/03	73-12-05	R	405	May 31/03
73-12-02		410	Nov 30/75	73-12-06		401	Aug 30/79
73-12-02	N	410 A	May 31/03	73-12-06		402	Aug 30/79
73-12-02	N	410 B	May 31/03	73-12-06		403	Aug 30/79
73-12-02		411	Aug 30/77	73-12-06		404	Aug 30/79
73-12-02		412	Aug 30/77	73-12-06		405	May 30/77
73-12-02		413	Feb 29/80	73-12-06		406	May 30/77
73-12-02		414	Feb 29/80	73-12-06		407	Aug 30/79

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
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73-12-06		409	May 30/77	73-13-03		402	May 30/81
73-12-06		410	Sep 30/87	73-13-03		403	May 30/81
73-12-06		411	Mar 27/97	73-13-03		404	May 30/81
73-12-06		412	Aug 30/79	73-13-03		405	May 30/81
73-12-06		413	Aug 30/79	73-13-03		406	May 30/81
73-12-06		414	Aug 30/79	73-13-03		407	May 30/81
73-12-06		415	Aug 30/79	73-13-03		408	May 30/81
73-12-06		501	May 30/80	73-13-03		409	May 30/81
73-12-06		502	May 30/77	73-13-03		410	Sep 30/87
73-12-06		503	May 30/77	73-13-03		411	Mar 27/97
73-12-06		504	May 30/77	73-13-03		412	Mar 27/97
73-12-06		601	Aug 30/80	73-13-03		413	Sep 30/87
73-12-06		602	Aug 30/80	73-13-04		401	Nov 30/78
73-12-06		603	Aug 30/80	73-13-04		402	Nov 30/75
73-12-06		604	Aug 30/80	73-13-04		403	Nov 30/75
73-12-06		605	Aug 30/80	73-13-04		404	Nov 30/75
73-12-07		401	May 30/79	73-13-05		401	Aug 30/78
73-12-07		402	May 30/79	73-13-05		402	Nov 30/78
73-12-07	R	403	May 31/03	73-13-05		403	May 30/79
73-12-07	R	404	May 31/03	73-13-05		404	Nov 30/78
73-12-07	R	405	May 31/03	73-13-05		405	Nov 30/78
73-12-07		501	May 30/83	73-13-06		401	Aug 30/80
73-12-07		502	May 30/83	73-13-06		402	Aug 30/80
73-12-07		503	May 30/83	73-13-06		403	May 30/80
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73-13-03		302	Nov 30/78	73-13-09		412	Aug 30/79
73-13-03		303	Nov 30/75	73-13-09		413	Aug 30/79
73-13-03		304	Feb 29/80	73-13-09		414	Aug 30/79

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
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73-13-09		416	Aug 30/79	73-14-01		306	May 30/79
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73-13-11		407	Nov 30/75	73-14-01		412	Sep 30/93
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73-14-00		9	Aug 30/77	73-14-02		603	Aug 30/77
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73-14-00		12	Aug 30/77	73-14-04		403	Nov 30/77
73-14-00		501	Feb 28/77	73-14-04		404	Nov 30/79
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73-14-00		503	Feb 28/77	73-14-04		406	Nov 30/79
73-14-00		504	Feb 28/77	73-14-04		407	Nov 30/79
73-14-01		301	Aug 30/77	73-14-04		501	Nov 30/79
73-14-01		302	Aug 30/77	73-14-04		502	Nov 30/79
73-14-01		303	Aug 30/77	73-14-04		503	Nov 30/77
73-14-01		304	Aug 30/77	73-14-05		401	Nov 30/77

CH/SE/SU	C	PAGE	DATE
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73-14-05		403	Nov 30/77
73-14-05		404	Nov 30/77
73-14-05		405	Nov 30/78
73-14-05		406	Nov 30/77
73-14-05		407	Nov 30/77
73-14-05		501	May 30/77
73-14-05		502	May 30/77
73-14-05		503	May 30/77
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73-14-11		403	Jun 30/75
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73-20-00		17	Mar 31/95
73-20-00		18	Feb 29/76
73-20-00		19	May 30/80
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73-20-00		21	Mar 31/95
73-20-00		22	Feb 29/76
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73-21-01		14	May 30/80
73-21-01		401	Feb 28/79
73-21-01	R	402	May 31/03
73-21-01	R	403	May 31/03
73-21-01		404	Feb 28/78
73-21-01		405	Feb 28/78
73-21-01		406	Feb 28/78
73-21-01		407	Nov 30/75
73-21-01		408	Nov 30/75
73-21-01		409	Feb 28/78
73-21-01		410	Feb 28/78
73-21-01		411	Nov 30/75
73-21-01		412	Feb 28/77
73-21-01		413	Feb 28/78
73-21-01		414	Nov 30/75
73-21-01		415	Nov 30/75
73-21-01		416	Nov 30/75
73-21-01		417	Aug 30/76
73-21-01		418	Feb 28/78
73-21-01		419	Nov 30/75
73-21-01	R	420	May 31/03
73-21-01		421	Nov 30/75
73-21-01		422	Nov 30/75
73-21-01	R	423	May 31/03
73-21-01	R	424	May 31/03
73-21-01	N	424 A	May 31/03
73-21-01	N	424 B	May 31/03
73-21-01		425	Nov 30/75
73-21-01		426	Aug 30/78
73-21-01		427	Aug 30/78
73-21-01		428	Aug 30/78
73-21-01		429	Mar 31/95
73-21-01		430	Aug 30/78
73-21-01		431	Aug 30/78
73-21-01		432	May 30/79
73-21-01		433	May 30/79
73-21-01		434	May 30/79
73-21-01		435	May 30/79
73-21-01		436	May 30/79
73-21-01		437	Mar 30/01

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73-21-01		438 A	Mar 30/01
73-21-01		438 B	May 30/83
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73-21-01		440	Aug 30/78
73-21-01		441	Feb 28/77
73-21-01		442	Aug 30/78
73-21-01	R	443	May 31/03
73-21-01	R	444	May 31/03
73-21-01	R	445	May 31/03
73-21-01	R	446	May 31/03
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73-21-01	D	446 B	
73-21-01	R	447	May 31/03
73-21-01		448	Aug 30/78
73-21-01		449	Feb 28/77
73-21-01		450	Aug 30/78
73-21-01		451	Aug 30/78
73-21-01		452	Aug 30/78
73-21-01		501	May 30/80
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73-21-01		512	Nov 30/82
73-21-01		513	Nov 30/82
73-21-01		514	Nov 30/82
73-21-01		515	Nov 30/81
73-21-01		516	Nov 30/81
73-21-01		601	Mar 30/01
73-21-01		602	Mar 27/97
73-22-00		1	Mar 31/95
73-22-00		2	Aug 30/76
73-22-00		3	Aug 30/76
73-22-00		4	Mar 31/95
73-22-00		5	Mar 31/95
73-22-00		501	Nov 30/78
73-22-00		502	May 30/78
73-22-00		503	Nov 30/78
73-22-00		504	Nov 30/78
73-22-11		401	May 30/76
73-22-11		402	May 30/76

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73-23-01		2	Nov 30/75
73-23-01		3	Nov 30/75
73-23-01		4	Nov 30/75
73-23-01		5	Nov 30/75
73-23-01		6	Nov 30/75
73-23-01		7	Nov 30/75
73-23-01		8	Nov 30/75
73-23-01		401	Mar 30/01
73-23-01		402	Mar 30/01
72-23-01		402 A	Mar 30/01
72-23-01		402 B	Mar 30/01
73-23-01		403	May 30/76
73-23-01		404	Feb 28/77
73-23-01		405	May 30/80
73-23-01		406	May 30/76
73-23-01		407	Feb 28/77
73-23-01		408	May 30/76
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73-23-01		420	Mar 31/95
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73-23-01		423	May 30/80
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73-23-01		502	May 30/77
73-23-01		503	Feb 28/77
73-23-01		504	Feb 28/77
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73-23-01		507	May 30/80
73-23-01		508	May 30/77
73-23-01		509	May 30/77
73-23-01		510	May 30/77
73-23-02		401	Nov 30/75
73-23-02		402	Nov 30/75
73-23-03		401	Feb 28/79
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73-23-03		403	Feb 28/79
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73-23-03		501	Feb 28/79	73-32-01		404	Aug 30/78
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73-23-03		503	Feb 28/79	73-32-01		502	Aug 30/77
73-23-03		504	Feb 28/79	73-32-01		503	Aug 30/77
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73-23-03		517	Feb 28/79	73-32-01		516	Aug 30/77
73-23-03		518	Feb 28/79	73-32-11		401	Feb 28/79
73-23-03		519	Feb 28/79	73-32-11		402	Feb 28/79
				73-32-11		403	Sep 30/90
73-24-01		401	May 30/77				
73-24-01		402	May 30/77	73-33-00		1	Jun 30/75
73-24-01		403	May 30/80	73-33-00		2	Jun 30/75
				73-33-00		3	Jun 30/75
73-30-00		1	May 30/80	73-33-00		4	Jun 30/75
73-30-00		2	Nov 30/75	73-33-00		5	Jun 30/75
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73-30-00		4	Mar 31/95	73-33-00		7	Jun 30/75
73-30-00		5	Nov 30/75	73-33-00		8	Jun 30/75
73-30-00		6	Nov 30/75	73-33-00		9	Jun 30/75
73-30-00		7	Nov 30/75	73-33-00		10	Jun 30/75
73-30-00		401	Aug 30/78	73-33-00		11	Jun 30/75
73-30-00		402	Aug 30/77	73-33-00		12	Jun 30/75
73-30-00		403	Aug 30/78	73-33-00		13	Jun 30/75
73-30-00		404	May 30/77	73-33-00		14	Jun 30/75
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73-30-00		501	Aug 30/78	73-33-00		16	Aug 30/75
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73-31-01		401	Feb 28/77	73-33-00		18	Jun 30/75
73-31-01		402	Feb 28/77	73-33-00		401	Nov 30/77
73-31-01		403	Nov 30/77	73-33-00		402	Nov 30/77
73-31-01		404	Feb 28/77	73-33-00		403	Nov 30/77
73-31-01		405	Feb 28/77	73-33-00		404	Nov 30/77
73-31-01		501	Feb 28/77	73-33-00		501	Feb 29/76
73-31-01		502	Nov 30/77	73-33-00		502	Feb 29/76
73-31-01		503	Feb 28/77	73-33-00		503	Aug 30/78
				73-33-00		504	Aug 30/78
73-32-01		401	Aug 30/78	73-33-00		505	Aug 30/78

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73-33-00		508	Aug 30/78
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73-33-00		510	Aug 30/78
73-33-00		511	Aug 30/78
73-33-00		512	Aug 30/78
73-33-00		513	Aug 30/78
73-33-01		401	Nov 30/78
73-33-01		402	Nov 30/78
73-33-01		403	Nov 30/75
73-33-01		404	May 30/77
73-33-01		405	May 30/77
73-33-01		501	May 30/80
73-33-01		502	Aug 30/77
73-33-01		503	Aug 30/77
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73-33-01		512	May 30/77
73-33-01		513	Aug 30/77
73-33-01		514	Aug 30/77
73-33-02		401	May 30/77
73-33-02		402	May 30/77
73-33-02		403	May 30/77
73-33-02		404	May 30/77
73-33-02		405	Nov 30/78
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73-33-02		407	Nov 30/78
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73-33-11		404	Nov 30/79
73-33-11		501	Aug 30/75
73-33-11		502	Aug 30/75
73-33-12		401	Mar 30/01
73-33-12		402	Mar 30/01
73-33-12		403	Mar 30/01
73-33-12		501	Aug 30/75
73-33-12		502	Aug 30/75
73-33-13		401	Nov 30/77
73-33-13		402	May 30/76
73-33-13		403	Nov 30/77
73-33-13		404	May 30/76
73-33-13		501	Jun 30/75
73-33-13		502	Jun 30/75
73-33-13		503	Aug 30/75
73-33-13		504	Aug 30/75
73-33-16		401	Nov 30/77
73-33-16		402	Jun 30/75
73-33-16		501	May 30/79
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73-33-16		503	May 30/79

SERVICE BULLETIN LIST

In the following service bulletin list, SB indicates an aircraft manufacturers bulletin, AEB indicates an airline engineering bulletin and OL indicates an engine manufacturers bulletin (complete identification OL.593-XX-XXX).

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 71-015		May 30/77	Embodied Power plant -Engine electrical cables - Introduction of stainless steel connectors
OL 72-058		May 30/79	Embodied Engine/Engine fuel and control -Combustion chamber outer case (CCOC)/Fuel sprayers (pilot) - Introduction of gaskets
OL 73-A34			Applicable Engine fuel and control -First stage fuel pump (FSP) - Life limitation and/or inspection imposed on pump
OL 73-A34	01		Applicable Engine fuel and control -First stage fuel pump (FSP) - Life limitation and/or inspection imposed on pump
OL 73-A34	02		Applicable Engine fuel and control -First stage fuel pump (FSP) - Life limitation and/or inspection imposed on pump
OL 73-A34	03		Applicable Engine fuel and control -First stage fuel pump (FSP) - Life limitation and/or inspection imposed on pump
OL 73-A34	04		Applicable Engine fuel and control -First stage fuel pump (FSP) - Life limitation and/or inspection imposed on pump
OL 73-A34	05		Applicable Engine fuel and control -First stage fuel pump (FSP) - Life limitation and/or inspection imposed on pump
OL 73-001		May 30/77	Embodied Engine fuel and control -Fuel pipe system - New drain valve assembly
OL 73-002			Applicable Engine fuel and control/Engine indicating - Temperature bulbs -Modified bulb flanges
OL 73-003			Applicable Engine fuel and control -Various -New

SERVICE BULLETIN LIST

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			plate seals
OL 73-004			Applicable Engine fuel and control -Second stage fuel pump -Simplified inlet connection
OL 73-005			Applicable Engine fuel and control -Engine flow control unit (FCU) -Alterations to electropressure control (LPC)
OL 73-006			Applicable Engine fuel and control -Tubes first stage pump supply to reheat injection system -Modified blanking plate
OL 73-006	01		Applicable Engine fuel and control -Tubes first stage pump supply to reheat injection system -Modified blanking plate
OL 73-006	02		Applicable Engine fuel and control -Tubes first stage pump supply to reheat injection system -Modified blanking plate
OL 73-007			Embodied Engine fuel and control -Fuel inlet elbow and drain valve -Main fuel inlet connection bolt material change
OL 73-007	01		Applicable Engine fuel and control -Fuel inlet elbow and drain valve -Main fuel inlet connection bolt material change
OL 73-007	02		Applicable Engine fuel and control -Fuel inlet elbow and drain valve -Main fuel inlet connection bolt material change
OL 73-008			Applicable Engine fuel and control -Shut-off distributor -Improvement in assembly configuration of
OL 73-008	01		Applicable Engine fuel and control -Shut-off distributor -Improvement in assembly configuration of
OL 73-008	02		Applicable Engine fuel and control -Shut-off distributor -Improvement in assembly configuration of

*SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-008	03		Applicable Engine fuel and control - Shut-off distributor - Improvement in assembly configuration of
OL 73-009			Applicable Engine fuel and control - Yokes spray ring - Change in material of
OL 73-009	01		Applicable Engine fuel and control - Yokes spray ring - Change in material of
OL 73-009	02		Applicable Engine fuel and control - Yokes spray ring - Change in material of
OL 73-010			Embodied Engine fuel and control - Reheat ignition - Improvement of
OL 73-010	01		Applicable Engine fuel and control - Reheat ignition - Improvement of
OL 73-010	02		Applicable Engine fuel and control - Reheat ignition - Improvement of
OL 73-011			Applicable Engine fuel and control - Electric starter pump-revised calibration
OL 73-011	01		Applicable Engine fuel and control - Electric starter pump-revised calibration
R OL 73-011			CANCELLED
OL 73-012			Applicable Engine fuel and control - Fuel sprayers (pilot) - New spinner and disk
OL 73-013			Applicable Engine fuel and control - Fuel sprayers (pilot) - Positive retained fuel tube and repositioned weld
OL 73-014			Embodied Engine fuel and control - Engine flow control unit - Various changes to electro-pressure control (LPC)
OL 73-015			Applicable Engine fuel and control - LP compressor low speed governor amplifier - Circuitry changes

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-016			Applicable Engine fuel and control - Distribution and dump valve - Introduction of fluorocarbon seals
OL 73-016	01		Applicable Engine fuel and control - Distribution and dump valve - Introduction of fluorocarbon seals
OL 73-017			Applicable Engine fuel and control - Electric starter pump - Introduction of fluorocarbon seals
OL 73-018			Applicable Engine fuel and control - Lucas second stage pump - Revised outer exhaust fairing plate
OL 73-019		May 30/77	Embodied Engine fuel and control - First stage fuel pump (FSP) - New inner face seal assembly
OL 73-020		May 30/77	Embodied Engine fuel and control - Second stage fuel pump - New taper bladed turbine wheel
OL 73-021			Applicable Engine fuel and control - Second stage fuel pump - Introduction of fluorocarbon seals
R OL 73-021	01		Applicable Engine fuel and control - Second stage fuel pump - Introduction of fluorocarbon seals
OL 73-022			Applicable Engine fuel and control - Engine flow control unit (FCU) - Introduction of fluorocarbon seals
R OL 73-022	01		Applicable Engine fuel and control - Engine flow control unit (FCU) - Introduction of fluorocarbon seals
OL 73-023			Applicable Engine fuel and control - First stage pump - Introduction of fluorocarbon seals

	SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
	OL 73-024			Applicable Engine fuel and control - Second stage pump - Revised material for retaining nuts in high temperature areas
	OL 73-025			Applicable Engine fuel and control - Actuator gear-box - Introduction of fluorocarbon seals
	OL 73-025	01		Applicable Engine fuel and control - Actuator gear-box - Introduction of fluorocarbon seals
	OL 73-026			Applicable Engine fuel and control - Engine flow control unit (FCU) - Introduction of a compression spring
	OL 73-027			Applicable Engine fuel and control Engine flow control unit (FCU) - Introduction of revised pressure drop spring anti-rotation mechanism
	OL 73-027	01		Applicable Engine fuel and control - Engine flow control unit (FCU) - Introduction of revised pressure drop spring anti-rotation mechanism
R	OL 73-027	02		Applicable Engine fuel and control - Engine flow control unit (FCU) - Introduction of revised pressure drop spring anti-rotation mechanism
	OL 73-028			Applicable Engine fuel and control - Second stage fuel pump - Introduction of revised support nozzle
	OL 73-029			Applicable Engine fuel and control - Engine flow control unit (FCU) - Introduction of Corruplus seal
	OL 73-030			Applicable Engine fuel and control - Distribution and dump valve (DDV) - Introduction of modified DDV piston

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-031			Applicable Engine fuel and control - Reheat fuel controller - Metering valve - Modification of
OL 73-031	01		Applicable Engine fuel and control - Reheat fuel controller - Metering valve - Modification of
OL 73-031	02		Applicable Engine fuel and control - Reheat fuel controller - Metering valve - Modification of
OL 73-031	03		Applicable Engine fuel and control - Reheat fuel controller - Metering valve - Modification of
OL 73-031	04		Applicable Engine fuel and control - Reheat fuel controller - Metering valve - Modification of
OL 73-032			Applicable Engine fuel and control - Engine flow control unit (FCU) - HP governor - Intro-duction of tungsten carbide pads
OL 73-033			Applicable Engine fuel and control - First stage fuel pump - Revised anti-rotation dowels and seal abutment plate
OL 73-033	01		Applicable Engine fuel and control - First stage fuel pump - Revised anti-rotation dowels and seal abutment plate
OL 73-034			Applicable Engine fuel and control - First stage pump Introduction on engines of first stage pump types FSP.117 and 117M to the standard of Lucas Modification No.CP.5379.
OL 73-034	01		Applicable Engine fuel and control - First stage pump Introduction on engines of first stage pump types FSP.117 and 117M to the standard of Lucas Modification No.CP.5379.

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-035			Not applicable
OL 73-034			Applicable Engine fuel and control - First stage pump - Introduction on engines of first stage pumps types FSP.117 and 117M to the standard of Lucas Modification No. CP.5379.
OL 73-036		Nov 30/77	Embodied Engine fuel and control - Fuel heater and filter - Modified bracket assembly
OL 73-037		Nov 30/77	Embodied Engine fuel and control - Fuel heater and filter - Introduction of fuel heater and filter type E.13342 to standard of DG MOD.NO. DG.109/deletion of Rolls-Royce limited supply items.
OL 73-037	01	Nov 30/77	Embodied Engine fuel and control - Fuel heater and filter - Introduction of fuel heater and filter type E.13342 to standard of DG MOD.NO. DG.109/deletion of Rolls-Royce limited supply items.
OL 73-038		May 30/77	Embodied Engine fuel and control - Fuel heater and filter - Introduction on engines of fuel heater and filter type E.13342 to the standard of Delaney Gallay modification DG.113
OL 73-038	01	May 30/77	Embodied Engine fuel and control - Fuel heater and filter - Introduction on engines of fuel heater and filter type E.13342 to the standard of Delaney Gallay modification D.G.113
OL 73-039		Nov 30/77	Embodied Engine fuel and control - Reheat fuel injection system-change in material for the flame holder
OL 73-039	01		Embodied Engine fuel and control - Reheat fuel injection system-change in material for the flame holder

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-039	02		Embodied Engine fuel and control - Reheat fuel injection system-change in material for the flame holder
OL 73-039	03		Embodied Engine fuel and control - Reheat fuel injection system-change in material for the flame holder
OL 73-040			Applicable Engine fuel and control - Fuel heater and filter - Introduction on engines of fuel heater and filter type E.13342 to the standard of Delaney Gallay modification DG.111
OL 73-040	01		Applicable Engine fuel and control - Fuel heater and filter - Introduction on engines of fuel heater and filter type E.13342 to the standard of Delaney Gallay modification D.G.113
OL 73-041		Nov 30/77	Embodied Engine fuel and control - Fuel heater and filter - Deletion of switch (Differential Pressure)
OL 73-041	01		Embodied Engine fuel and control - Fuel heater and filter - Deletion of switch (Differential Pressure)
OL 73-042			Applicable Engine fuel and control - Engine fuel control - Introduction on engines of fuel control unit (FCU) types FCU.117 and FCU. 117M to the standard of Lucas modification C.P.5290
OL 73-042	01		Applicable control - Introduction on engines of fuel control unit (FCU) Types FCU117 and FCU117M to the standard of Lucas modification CP5290

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-042 02			Applicable Engine fuel and control - Engine fuel control - Introduction on engines of fuel control unit (FCU) Types FCU117 and FCU117M to the standard of Lucas modification CP5290 Engine fuel and control - Engine fuel
OL 73-043			Embodied Engine fuel and control - Flow control units - Introduction on engines of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP5163
R OL 73-043 01			Embodied Engine fuel and control - Flow control units - Introduction on engines of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP5163
OL 73-044			Embodied Engine fuel and control - Flow control unit - Introduction on engines of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP4860
OL 73-045			Applicable Engine fuel and control - Distribution dump valve - Introduction on engines of distribution dump valves Type DDV.102 or 102M to the standard of Lucas modification CP5164
OL 73-046			Applicable Engine fuel heater control unit - Introduction of fuel heater control units type L.83020-00-000 to the standard of Negretti and Zambra Mod. M2036
OL 73-047			Applicable Engine fuel and control - Reheat injection system - Flame holder - Modification of

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-047	01		Applicable Engine fuel and control - Reheat injection system - Flame holder - Modification of
OL 73-047	02		Applicable Engine fuel and control - Reheat injection system - Flame holder - Modification of
OL 73-047	03		Applicable Engine fuel and control - Reheat injection system - Flame holder - Modification of
OL 73-048			Embodied Engine fuel and control - Flow control units (FCU) - Introduction on engines of flow control units Types FCU117 and FCU117M to the standard of Lucas modification CP5095
OL 73-049			Applicable Engine fuel and control - Reheat fuel controller - Modification of the shut-off valve
OL 73-049	01		Applicable Engine fuel and control - Reheat fuel controller - Modification of the shut-off valve
OL 73-049	02		Applicable Engine fuel and control - Reheat fuel controller - Modification of the shut-off valve
R OL 73-050			Not applicable Engine fuel and control - Reheat purge solenoid valve - Change in core guide material
OL 73-051			Applicable Engine fuel and control - LP governor control amplifier - Introduction of change of datum and standing current level to the standard of Lucas modification CP5503
OL 73-051	01		Applicable Engine fuel and control - LP governor control amplifier - Introduction of change of datum and standing current level to the standard of Lucas modification CP5503

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-051	02		Applicable Engine fuel and control - LP governor control amplifier - Introduction of change of datum and standing current level to the standard of Lucas modification CP5503
OL 73-051	03		Applicable Engine fuel and control - LP governor control amplifier - Introduction of change of datum and standing current level to the standard of Lucas modification CP5503
OL 73-052			Applicable Engine fuel and control - Fuel sprayers inlet thermometer - Shorter securing bolts
OL 73-053			Applicable Engine fuel and control - Engine flow control unit (FCU) - Introduction on engines of flow control unit types FCU117 and FCU117M to the standard of Lucas modification CP5238
OL 73-054			Applicable Engine fuel and control - Flow control unit (FCU) - Introduction on engines of flow control unit types FCU117 and FCU117M to the standard of Lucas modification CP5304
OL 73-054	01		Applicable Engine fuel and control - Flow control unit (FCU) - Introduction on engines of flow control unit types FCU117 and FCU117M to the standard of Lucas modification CP5304
OL 73-054	02		Applicable Engine fuel and control - Flow control unit (FCU) - Introduction on engines of flow control unit types FCU117 and FCU117M to the standard of Lucas modification CP5304
OL 73-055			Not applicable
R OL 73-055			CANCELLED

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-056			Applicable Engine fuel and control - Flow control unit - Introduction on engines Type FCU117 and FCU117M of flow control unit to standard of Lucas modification CP5343
OL 73-056	01		Applicable Engine fuel and control - Flow control unit - Introduction on engines Type FCU117 and FCU117M of flow control unit to standard of Lucas modification CP5343
OL 73-057			Applicable Engine fuel and control - Electric starter pumps - Introduction on engines of electric starter pumps Types ESP.102 and ESP.102M to to the standard of Lucas modification CP5462
OL 73-058			Applicable Engine fuel and control - Second stage fuel pump - Introduction on engines of second stage pump Types SSP.106 and SSP.106M to the standard of Lucas modification CP4987
R OL 73-058	01		Applicable Engine fuel and control - Second stage fuel pump - Introduction on engines of second stage pump Types SSP.106 and SSP.106M to the standard of Lucas modification CP4987
R OL 73-058	02		Applicable Engine fuel and control - Second stage fuel pump - Introduction on engines of second stage pump Types SSP.106 and SSP.106M to the standard of Lucas modification CP4987
OL 73-059			Applicable Engine fuel and control - Fuel differential pressure warning light switch - Introduction on engines of unit to the standard of Smiths modification No. B1068

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-060			Applicable Engine fuel and control - Flow control unit - Introduction on engines of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP5364
OL 73-061			Applicable Engine fuel and control - Flow control unit - Introduction on engines of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP5625
OL 73-061	01		Applicable Engine fuel and control - Flow control unit - Introduction on engines of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP5625
OL 73-062			Applicable Engine fuel and control - Tubes electric starter pump supply to flow control unit - Deletion of fluid filter assembly
OL 73-063			Applicable Engine fuel and control - Flow control unit - Introduction on engines of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP4957
OL 73-064			Applicable Engine fuel and control - Flow control unit - Introduction on engines of flow control unit(FCU) Types FCU117 and FCU117M to the standard of Lucas modification CP5094
OL 73-066			Applicable Engine fuel and control - Distribution dump valve - Introduction on engines of distribution dump valve Type DDV.102 or 102M to the standard of Lucas modification CP5486
OL 73-067			Applicable Engine fuel and control - Second stage pump - Introduction on engines of second stage pump Types SSP105, SSP105M, SSP106 and SSP106M to the standard of Lucas modification CP5344

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
OL 73-068		May 30/79	Applicable Engine fuel and control - Revised installation procedure for fuel pressure atomising (pilot) nozzles
OL 73-069			Applicable Engine fuel and control - Second stage pump inlet elbow return to recirculation valve fuel tube - Inspection for frettage
OL 73-069	01		Applicable Engine fuel and control - Second stage pump inlet elbow return to recirculation valve fuel tube - Inspection for frettage
OL 73-070			Applicable Engine fuel and control - Distributor dump valve - Introduction on engines of distributor dump valve Types DDV102 and DDV102M to the standard of Lucas modification CP5628
OL 73-070	01		Applicable Engine fuel and control - Distributor dump valve - Introduction on engines of distributor dump valve Types DDV102 and DDV102M to the standard of Lucas modification CP5628
OL 73-071			Applicable Engine fuel and control - Reheat injection system - Introduction of a foolproof reheat igniter installation configuration on the light-up fuel tube
OL 73-072			Applicable Engine fuel and control/Power plant/ Engine/Air/Oil - Various tubes - Change of tube clamp bush material from knitmesh to PTFE
R OL 73-072	01		Applicable Engine fuel and control/Power plant/ Engine/Air/Oil - Various tubes - Change of tube clamp bush material from knitmesh to PTFE
OL 73-073			Applicable Engine fuel and control- Flow control unit (FCU) - Inspection of input drive gear train at or before 3000 hours

	SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
R	OL 73-073	01		Applicable Engine fuel and control- Flow control unit (FCU) - Inspection of input drive gear train at or before 3000 hours
	OL 73-074			Applicable Engine fuel and control/Power plant/ Engine/Air/Oil - Various tubes - Change of tube clamp bush material from knitmesh to PTFE
R	OL 73-074	01		Applicable Engine fuel and control/Power plant/ Engine/Air/Oil - Various tubes - Change of tube clamp bush material from knitmesh to PTFE
	OL 73-075			Applicable Miscellaneous - Introduction of group service bulletin for record purposes only
	OL 73-076			Applicable Engine fuel and control - Flow control unit - Introduction on engines of flow control unit (FCU) Types FCU117 and FCU117M to the standard of Lucas modification CP5776
R	OL 73-077			Not issued
	OL 73-078			Applicable Engine fuel and control - Engine flow control unit (FCU) - Introduction on engines of flow control unit FCU117 and FCU117M to the standard of Lucas modification CP5729
	OL 73-079			Applicable Engine fuel and control - Flow control unit (FCU) - Introduction of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP5730
R	OL 73-080			Applicable Engine fuel and control - Second stage fuel pump - Introduction on engines of second stage pump Types 105, 105M and 106M to the standard of of Lucas modification CP5619

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
R OL 73-080	01		Applicable Engine fuel and control - Second stage fuel pump - Introduction on engines of second stage pump Types 105, 105M and 106M to the standard of of Lucas modification CP5730
R OL 73-081			Applicable Engine fuel and control - Introduction of new seal plates
R OL 73-081	01		Applicable Engine fuel and control - Introduction of new seal plates
R OL 73-082			Applicable Engine fuel and control - Distribution and dump valve (DDV) - Introduction on engines of distribution and dump valves DDV 102 and DDV 102M to the standard of Lucas modification CP5695
R OL 73-083			Applicable Engine - Air/engine fuel and control - Anti-icing and fuel heating air valves to the standard of Normalair Garrett modification 340FC
R OL 73-084			Applicable Engine fuel and control - Electric starter pump - Introduction on engines of electric starter pumps Types ESP 102 and ESP 102M to the standard of Lucas modification CP5975
R OL 73-085			Applicable Engine fuel and control - Second stage fuel pump - Introduction of revised butterfly shaft bearings to the standard of Lucas modification CP5938
R OL 73-085	01		Applicable Engine fuel and control - Second stage fuel pump - Introduction of revised butterfly shaft bearings to the standard of Lucas modification CP5938

	SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
R	OL 73-086			Not Applicable Engine fuel and control - Flow control unit (FCU) - HP overspeed governor - Revision to frequency of maintenance task
R	OL 73-086	01		Not Applicable Engine fuel and control - Flow control unit (FCU) - HP overspeed governor - Revision to frequency of maintenance task
R	OL 73-086	02		Not Applicable Engine fuel and control - Flow control unit (FCU) - HP overspeed governor - Revision to frequency of maintenance task
R	OL 73-087			Applicable Engine fuel and control - Flow control unit (FCU) - Introduction on engines of flow control unit Types FCU 117 and FCU 117M to the standard of Lucas modification CP5937
R	OL 73-088			Applicable Engine fuel and control - Introduction of selected fuel system tubes insulated with HITCO graphite cloth
R	OL 73-088	01		Applicable Engine fuel and control Introduction of selected fuel system tubes insulated with HITCO graphite cloth
R	OL 73-089			Applicable Engine fuel and control - Flow control unit (FCU) - Introduction on engines of flow control unit (FCU) Types FCU117 and FCU117M to the standard of Lucas modification CP6030
R	OL 73-090			Applicable Engine fuel and control - Flow control unit (FCU) - Introduction on engines of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP5993

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
R OL 73-091			Applicable Engine fuel and control - Flow control unit (FCU) - Introduction on engines of flow control unit (FCU) Types FCU117 and FCU117M to the standard of Lucas modification CP6070
R OL 73-092			Not Applicable Engine fuel and control - Fuel pressure atomising (main) nozzle assembly - Inspection of nozzle assembly weld joints and wall section
R OL 73-092	01		Not Applicable Engine fuel and control - Fuel pressure atomising (main) nozzle assembly - Inspection of nozzle assembly weld joints and wall section
R OL 73-092	02		Not Applicable Engine fuel and control - Fuel pressure atomising (main) nozzle assembly - Inspection of nozzle assembly weld joints and wall section
R OL 73-093			Not Applicable Engine - Fuel and control fuel pressure - Atomising (Pilot) nozzle assembly - New maintenance task
R OL 73-093	01		Not Applicable Engine - Fuel and control fuel pressure - Atomising (Pilot) nozzle assembly - New maintenance task
R OL 73-094			Applicable Engine fuel and control - Flow control unit (FCU) - Introduction on engines of flow control unit Types FCU117 and FCU117M to the standard of Lucas modification CP4305
R OL 73-095			Applicable Engine fuel and control - Introduction of fuel heater control units Type L83020-00-000 to the standard of Negretti Aviation modification M3186

	SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
R	OL 73-096			Applicable Engine fuel and control - Reheat fuel controller - Modification of the shut-off valve
R	OL 73-096	01		Applicable Engine fuel and control - Reheat fuel controller - Modification of the shut-off valve
R	OL 73-097			Applicable Engine fuel and control - Distribution and dump valve (DDV) - Introduction of distribution and dump valves DDV 102 and DDV 102M to the standard of Lucas modification CP6682
R	OL 73-098			Applicable Engine fuel and control - Reheat fuel controller modification of the elbow connector
R	OL 73-098	01		Applicable Engine fuel and control - Reheat fuel controller modification of the elbow connector
R	OL 73-098	02		Applicable Engine fuel and control - Reheat fuel controller modification of the elbow connector
R	OL 73-099			Applicable Engine fuel and control - Reheat fuel control unit (RFCU) - Introduction of metering valve motor with integral fly lead
R	OL 73-100			Not Applicable Fuel and control - LP compressor N_1 overspeed governor check - Periodicity
R	OL 73-101			Not Applicable Engine fuel and control - Reheat fuel control unit (RFCU) - Introduction of new seal on the shut off valve
	OL 74-001		May 30/79	Embodied Ignition/Engine fuel and control - Engine igniter plugs/fuel sprayer (pilot) Introduction of adjusting washer retaining clip

	SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
	OL 77-010		May 30/77	Embodied Engine Indicating - Engine power pitots - New pitot tube
	OL 77-011		May 30/77	Embodied Engine Indicating - Engine power pitots - Additional support brackets
	SB 71-010		Feb 28/77	Embodied
	SB 73-001		Feb 28/77	Embodied
	SB 73-007		Feb 28/77	Embodied
	SB 71-010		Nov 30/76	Embodied
	SB 73-001		Feb 28/77	Embodied
	SB 73-007		Nov 30/76	Embodied
	SB 73-013		Nov 30/76	Embodied
	SB 71-039		Aug 30/77	Embodied Power Plant - Inspection of fuel filter outlet to tube junction, tube part No.B8489188 for fretting and clearance
	SB 73-001			Not applicable
	SB 73-002			No effect Engine - Fuel and Control - Installation of Type 7B3 Reheat Gutter (Rolls Royce SB 73-14050-145)
	SB 73-003			No effect Engine - Fuel and Control, LP Governor Control Amplifier - To introduce a new standard of amplifier
	SB 73-004			Applicable Engine - Fuel and Control - Engine Fuel Control Unit - To introduce a new standard of unit
	OL 73-102			Applicable Engine Fuel and Control - Fuel Tubes with new insulation materials for fire protection
R	OL 73-102	01		Applicable Engine Fuel and Control - Fuel Tubes with new insulation materials for fire protection
	OL 76-52	01	Mar 31/95	Embodied Engine Control - Reheat system - Deletion of controlled purge function of the reheat purge solenoid valve

	SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
	OL 73-103			Not applicable Engine Fuel and Control - Second Stage Fuel Pump - Type 105, 105M, 106 and 106M - Additional 10 hour endurance test
	OL 73-104			Not applicable Engine Fuel and Control - Distribution and dump valve - Introduction of valve to the standard of Lucas Modification CP8088
	OL 73-105			Not applicable Engine Fuel and Control - Electric starter pump - Introduction of pump to the standard of Lucas Modification CP8089
	OL 73-106			Not applicable Engine Fuel and Control - Fuel Control Unit - Introduction of unit to the standard of Lucas Modification CP8090
	OL 73-107			Not applicable Engine Fuel and Control - Second stage fuel pump - Introduction of pump to the standard of Lucas Modification CP8092
	OL 73-108			Not applicable Engine Fuel and Control - Fuel Control Unit - Introduction of unit to the standard of Lucas Modification CP8093
R	OL 73-108	01		Not applicable Engine Fuel and Control - Fuel Control Unit - Introduction of unit to the standard of Lucas Modification CP8093
R	OL 73-109			Applicable Engine Fuel and Control - Fuel Filter Inspection/Fuel Analysis - Introduction of liner trays in the fuel tanks
R	OL 73-109	01		Applicable Engine Fuel and Control - Fuel Filter Inspection/Fuel Analysis - Introduction of liner trays in the fuel tanks

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
R OL 73-110			Not applicable Engine Fuel and Control - First Stage Pump - FSP 117 inspection of filter and bearings fuel feed passageways for debris

CHAPTER 73

ENGINE FUEL AND CONTROL

TABLE OF CONTENTS

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GENERAL

1. General

Engine fuel and control components can be divided into two groups; engine fuel flow system and reheat fuel flow system. The components of these systems are described separately in the chapters indicated on the illustration (Ref. Fig. 001).

The engine fuel flow system includes three pumps, an
electrically driven starter pump, an engine driven first
stage fuel pump and a second stage fuel pump driven by an
air turbine. The turbine of the second stage is controlled
by a fuel servo pressure regulated, air throttle valve. A
fuel flow control unit (FCU) receives the pump output and
passes a metered flow to eight twin nozzle fuel pressure
R atomizing nozzle assemblies via a fuel distribution and
R dump valve. The FCU incorporates a fuel metering control
R loop, consisting of throttle valve, servo throttle valve
R and pressure drop unit, an hydraulically operated HP
R fuel shut-off valve, and overspeed governors for the HP and
R LP compressors. A throttle valve actuator gearbox is
R mounted below the FCU and incorporates two electric motors
R that provide alternative drives for the throttle valve of
R the FCU as described in 76-00-00. In addition to the
R distribution and dump valve provides for normal fuel dumping
R on engine shut-down and an emergency quick shut-down fuel
R dump system. The LP compressor shaft twist signal system
R that operates the quick shut-down valve is described in
R 76-21-00.

The reheat fuel flow system consists of a reheat fuel controller and purge valve serving the spray ring of a reheat injection system. The controller incorporates an electric motor to operate the fuel metering valve and a servo fuel operated reheat shut-off valve. The purge valve provides for air purging of the reheat system downstream of the controller.

2. Description of Component Installation (Ref. Fig. 002).

The first stage pump is secured to the front face of the left-hand gearbox by a quick attach/detach coupling and the FCU is similarly attached to the gearbox rear face. Both units are driven from the HP compressor shaft via the gearbox.

The heater and filter and the fuel inlet elbow are bolted, together with supporting links, to the first stage pump case. The second stage pump is bolted to the FCU, as is the throttle valve actuator gearbox, and the combined units form

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RECIRCULATION VALVE (73-10-00)

FIRST STAGE FUEL PUMP (73-10-00)

FUEL HEATER CONTROL THERMOMETER (73-14-00)

EJECTOR PUMP

FUEL DIFFERENTIAL PRESSURE WARNING SWITCH (73-30-00)

FUEL TUBES (73-13-00)

FUEL COOLED OIL COOLER (79-00-00)

HEATER AND FILTER (73-14-00)

POWER SUPPLY FROM STARTING SYSTEM (80-00-00)

M

ELECTRIC STARTER PUMP (73-10-00)

REHEAT FUEL FILTER (73-13-00)

M

REHEAT CONTROLLER (73–20–00)

S

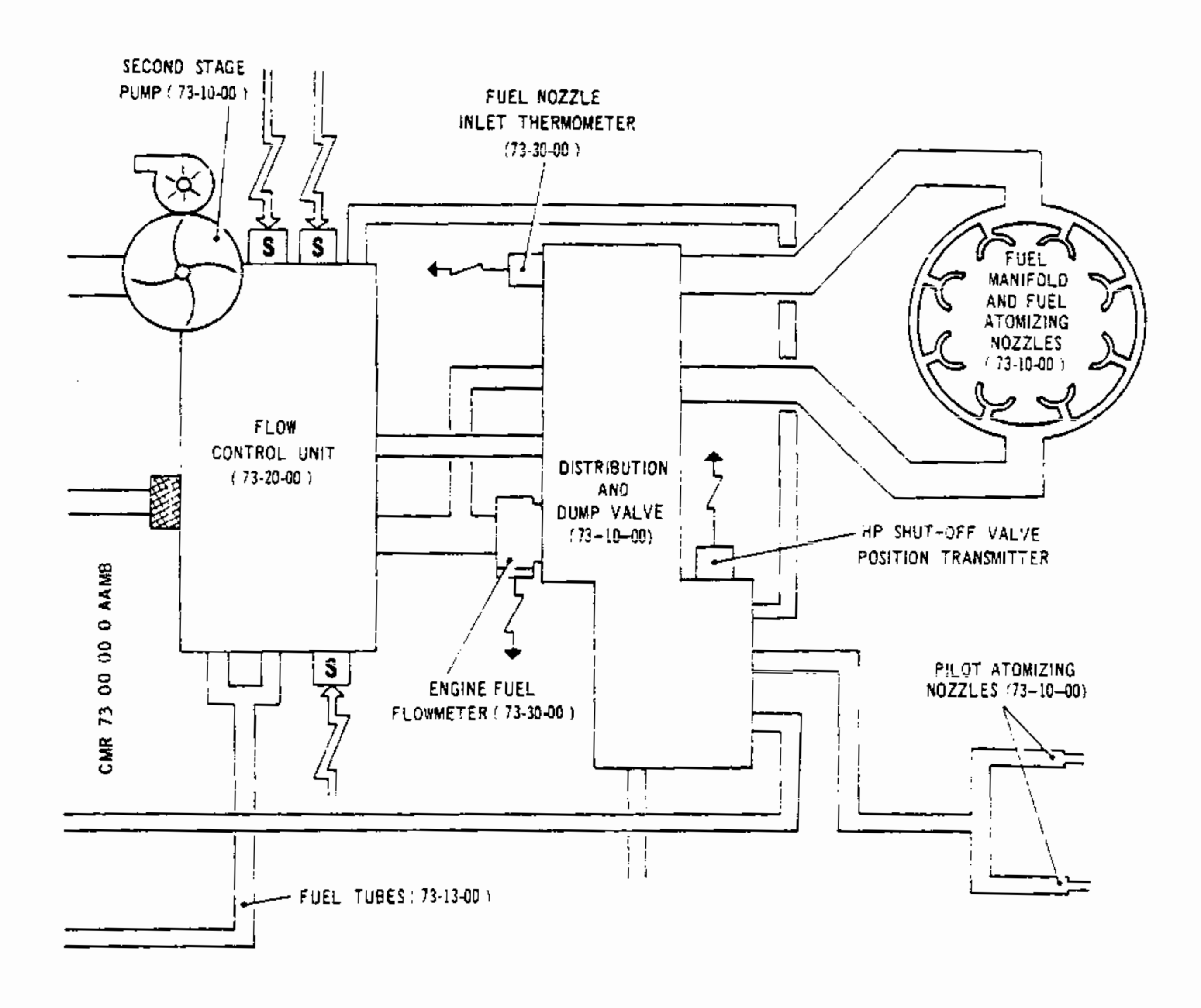
REHEAT FUEL FLOWMETER (73-30-00)

REHEAT INJECTION SYSTEM (73-10-00)

CMR 73 00 00 0 AAMA

Fuel Flow Diagram (Sheet 1 of 2)
Figure 001

CR 31511/00C



R

Fuel Flow Diagram (Sheet 2 of 2)
Figure 001

CR 31310/008

A
B
C
D
E
F
G
H
J

FUEL HEATER AND FILTER

FIRST STAGE PUMP

B

FUEL INLET ELBOW

RECIRCULATION VALVE

A

C

ELECTRIC STARTER PUMP

CMR 73 00 00 0 BAMA

Component Location and Mounting
(Sheet 1 of 2)
Figure 002

CR 31311/00B

FLOW CONTROL UNIT

ENGINE FLOWMETER

DISTRIBUTION AND DUMP VALVE

AIR BLEED VALVE

E

ACTUATOR GEARBOX (TV) (76-00-00)

SECOND STAGE PUMP

D

FUEL PRESSURE ATOMIZING (PILOT) NOZZLE

J

REHEAT FLOWMETER

F

REHEAT CONTROLLER

FUEL PRESSURE ATOMIZING NOZZLE ASSEMBLY

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G

H

FUEL MANIFOLD

REHEAT INJECTION SYSTEM

Component Location and Mounting
(Sheet 2 of 2)
Figure 002

a single assembly attached to the gearbox.

The distribution and dump valve and reheat fuel controller are bolted together and secured to engine mounted brackets. Fuel flowmeters are secured to the inlets of both units. An upper and lower manifold encircle the engine. Each of the manifolds is served by a separate outlet from the distribution valve and delivers fuel to four of the eight
R fuel pressure atomizing nozzles that are equally spaced
R around the diffuser case and bolted to it. Two fuel
R pressure atomizing (pilot) nozzles are mounted on the
R bottom of the combustion chamber outer case and project
R into the combustion system beside the igniter plugs.
R The electric starter pump is bolted to engine mounted
R brackets and has two outlet connections, one to the
R FCU and one to serve the pilot atomizing nozzles.

The reheat spray ring is mounted by short struts to the attachment lugs of its flame holder. Longer struts from the flame holder lugs to retaining lugs on the jet pipe thermocouple harness mounted on the exhaust diffuser support the complete reheat fuel injection system.

The recirculation valve is secured to engine mounted brackets near the oil tank rear lower mounting. A tube from the fuel outlet side of the oil cooler connects to the valve inlet. The valve outlet connects the fuel return to the aircraft fuel system.

Seal plates, used between fuel transfer tubes and components and the component adapters, have inner and outer seals, primary and secondary respectively, at each connecting location. The spaces formed between each pair of seals are interconnected to form a fuel seal failure drains system. This drains system is described in 71-73-00.

3. Operation

The fuel control system is designed to provide a continuous supply of fuel to the combustion systems at the flow rate necessary to obtain the power demanded by the engine and reheat control system (Ref. Fig. 002). The power demand is determined by the pilots' throttle lever setting, reheat control selection and the engine operation sensing signals which act on the fuel control system through the engine control system. For any given power demand made by the pilots' throttle lever, the engine control system will determine the flow control unit (FCU) throttle valve setting. The control system automatically compensates for variable factors affecting engine performance by resetting the throttle valve in response to sensed signals. The

primary function of the FCU is to maintain a predetermined pressure drop across the throttle valve and compensate automatically for any change of condition throughout the operating range, from starting to shut-down.

This predetermined pressure drop across the throttle valve ensures that the correct fuel flow rate is automatically maintained for any power demand. Engine overspeed protection and quick shut-down facilities are incorporated in the fuel control system and act directly and automatically on the fuel flow.

The reheat system is made operative from the flight compartment but is controlled automatically. Reheat will not be initiated unless the engine is within a safe operating range. The reheat fuel controller in response to sensing signals will meter fuel to the reheat spray ring. Should operating conditions exceed the safe range, then reheat will be stopped automatically. An air purge clears residual fuel from the spray ring and delivery tube when reheat is shut down.

Indication systems, described in 73-30-00, are provided to enable fuel temperature, fuel flow rate and consumption and HP shut-off valve position to be monitored.

GENERAL - SERVICING

1. General

This topic details the procedure for draining the fuel system of fuel or inhibiting oil in paragraph 2, priming the system and leak checking the drain points in paragraph 3, and the method of obtaining a fuel sample in paragraph 4, and
R the procedure for rectification of fuel system following
R hydraulic fluid contamination in paragraph 5.

2. Draining the Fuel System (Ref. Fig. 301)

A. General.

Two drain valves are provided. One valve drains the inlet elbow and first stage pump section and the other drains the fuel heater and filter section. To drain other sections of the system, it is necessary to remove blanking ferrules at the reheat filter, the junction of the tube heater and filter to oil cooler, the starter pump fuel supply elbow to the FCU and the tube flange at the engine flowmeter inlet.

B. Tools and Equipment.

Air bleed tube	PE.22898
Drain tube, for inlet elbow drain valve	PE.34076
Drain tube, for heater and filter drain valve	PE.21970
Circuit breaker safety clips	-

C. Prepare to Drain System.

(1) Open the engine bay front lower door (Ref.71-00-00 Servicing).

(2) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(3) Electrically isolate the engine additional services indicated in Table 301 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
L.P. Fuel Shut-off Valve	15-216 1-213	1Q1 1Q2	C1 J11
Engine No.2			
L.P. Fuel Shut-off Valve	15-215 3-213	2Q1 2Q2	C19 A5
Engine No.3			
L.P. Fuel Shut-off Valve	15-215 3-213	3Q1 3Q2	C20 A6
Engine No.4			
L.P. Fuel Shut-off Valve	15-216 1-213	4Q1 4Q2	C2 J12

Circuit Breakers
Table 301

D. Drain Fuel Inlet and Heater and Filter Sections.

(1) Unscrew dust cap and assemble bleed tube to air bleed valve near the distribution and dump valve; unscrew valve unit until open.

(2) Remove pressure cap from drain valve on fuel inlet elbow.

(3) Ensure that drain tube adapter is clean and direct free end of tube into drain container. Insert tube probe into drain valve, engage sleeve and screw on until fluid commences to drain.

(4) When fluid ceases to drain, remove tube from drain valve.

(5) Remove heater and filter drain valve pressure cap and repeat the draining procedure detailed in paragraph (3) and (4).

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A, SIMILAR AT D E F

B, SIMILAR AT C

G

CMR 73 00 00 3 AAM0

Draining Fuel from System
Figure 301

E. Drain Residual Fuel from other Sections.

(1) Drain fluid from reheat system at blanking ferrule on reheat filter cover.

(a) Unscrew union nut, remove blanking ferrule and allow fluid to drain into container.

(b) When fluid ceases to drain, apply lubricant A, (Ref. 70-00-01, Servicing and Storage Materials) to union nut and torque-tighten to between 190 and 210 lbf in. (21,5 and 23,7 N.m). Wire-lock union nut.

(2) Drain fluid from system between filter and oil cooler at blanking ferrule at junction on heater and filter to oil cooler tube. Carry out the procedures detailed in paragraph (1) (a) and (b).

(3) Drain fluid from system between oil cooler and FCU at blanking ferrule on starter pump fuel supply elbow to FCU. Carry out the procedures detailed in paragraph (1) (a) and (b).

(4) Drain fluid from system between FCU and distribution and dump valve at blanking ferrule on fuel tube flange at engine flowmeter. Carry out the procedure detailed in paragraph (1) (a) and (b).

(5) Close the air bleed valve and discard drained fluid.

(6) Carry out leak check of system drain connections concurrent with priming the system as detailed in paragraph 3.

3. <u>Priming the Fuel System and Leak Check Drain Points</u>

A. Prime the System.

(1) Ensure that all fuel connections are secure. Reset the LP fuel isolation valve circuit breaker (Ref. Table 301) and start the appropriate aircraft fuel feed pumps.

(2) Bleed all air from the system through the air bleed valve. When fuel flows free of air, close the bleed valve securely and remove air bleed valve tube assembly. Discard drained fuel.

B. Leak Check Drain Valves, Bleed Valves and Blanking

Ferrules Using Aircraft Fuel Feed Pumps.

(1) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valves and blanking ferrules. No leaks are acceptable.

(2) On satisfactory completion of check, switch off the aircraft feed pumps.

(3) Ensure seal is in position and assemble the dust cap to the air bleed valve. Tighten and wire-lock the cap.

(4) Assemble the pressure caps, with new seals, to the filter and heater and fuel inlet elbow drain valves. Tighten and wire-lock the caps.

(5) Close engine bay door (Ref.71-00-00, Servicing).

4. Take Fuel Sample

A. Tools and Equipment.

Drain tube for filter drain valve PE.21970

B. Prepare to Take Sample.

(1) Open the engine bay front lower door (Ref.71-00-00, Servicing).

(2) Open LP fuel isolation valve and ensure that valve indicator shows open.

C. Drain of Fuel Sample.

(1) Position a clean container of approximately 2 litre capacity below drain location.

(2) Remove heater and filter drain valve pressure cap.

(3) Ensure that tube adapter is clean and direct free end of tube into container. Fully insert tube probe into drain valve then engage sleeve one complete turn. If necessary continue to screw on sleeve until fuel commences to drain.

NOTE: The rate of drainage can be accelerated if the appropriate fuel feed pump is switched on.

(4) Allow 1 to 1.5 litres of fuel to drain then remove tube from drain valve.

(5) Ensure that valve is secure from leaks under feed pump pressure. Switch off feed pump.

(6) Assemble pressure cap to valve with a new seal. Tighten and wire-lock cap.

(7) Close engine bay door (Ref.71-00-00, Servicing).

(8) Carry out analysis of fuel sample in accordance with Chapter 12-32-00.

R R 5. <u>Rectification of Engine Fuel System Following Hydraulic Fluid Contamination</u>

R R A. Carry out the following rectification as soon as possible after discovery of contamination.

R B. Engine Able to Run.

R (1) Drain fuel system; para.2.

R (2) Prime fuel system; para.3.

R R R (3) Renew the reheat fuel controller ref.73-23-01 Remove/Installation. Ground run the engine on completion of installation.

R C. Engine Unable to Run.

R R R R R (1) Remove the first stage fuel pump, second stage pump, electric start pump, engine flow control unit and the distribution and dump valve as detailed in this chapter and thoroughly flush them with clean aviation fuel.

R (2) Re-install the components.

R R (3) Renew the reheat fuel controller: refer to 73-23-01. Removal/Installation.

GENERAL - ADJUSTMENT/TEST

1. General

A check for leaks in the fuel system can be made either during an engine run (Ref.71-00-00, Adjustment/Test) or by application of a static pressure using either the aircraft fuel feed pumps or a pressure test and inhibiting rig. The procedure for a leak check using the fuel feed pumps is given in paragraph 4 and the procedures for a system or part system leak check using a test rig are given in paragraphs 5, 6 and 7.

After work involving only a limited disturbance of connections has been done, then leak checks need only be carried out on the seals and units affected by the work done. Refer to the component Adjustment/Test procedure for details of a localized check of this type.

2. Tools, Equipment and Approved Materials

NOTE: Items of equipment are selected specific to the task to be carried out.

A. Tools and Equipment.

Pressure test and inhibiting rig (PTIR) ... PE.17988

Pressure test equipment items (contained in adapter set PE.29964) are required as follows:

R Adapter (Engine No. 1 or 3) 9970-531-043

R Adapter (Engine No.2 or 4) 9970-521-075

R Adapter (Pre S.B.OL.593-73-1 drain valve) PE.22972

R Adapter (S.B.OL.593-73-1 drain valve) ... PE.26710

R Blank, for purge valve air/fuel spill outlet tube connection ... ... -

Blank PE.20757

Blank PE.35092

Blanking unit (2) AS.15826

Blanking plug PE.29937

Blank/bleed valve	PE.35065
Clamp	PE.27277
Drain adapter	PE.20746
Drain adapter	PE.20748
Drain adapter	PE.27080
Drain adapter	PE.35666
Drain adapter	PE.29969
Drain adapter	PE.29971
Drain adapter (use in conjunction with AS.15826)	PE.29693
Hose	PE.28394
Hose	PE.22893
Air bleed tube	PE.22898
R Drain tube (Pre S.B.OL.593-73-1 drain valve)	PE.34076
R Drain tube (S.B.OL.593-1 drain valve) ...	PE.26796
Drain tube	PE.35201
R Circuit breaker safety clip	-

B. Approved Materials.

Test fluid

Aviation kerosine	D.Eng.R.D.2494
or	
Inhibiting fluid	DEF.2001A or D.Eng.R.D.2490

R

Lubricants	Refer to 70-00-01, Servicing and Storage Materials

3. Leak Check During Engine Run

A. General Leak Checks.

Check the fuel system for signs of leakage with the engine bay doors open in accordance with the procedure detailed in 71-00-00, Adjustment/Test. Carry out the initial leak checks with the engine running at the idle setting and check the reheat section with the reheat in operation. Use the press-to-test facility as a check for excessive gland seal leakage (Ref.12-25-12, Servicing).

If leaks are disclosed by the check, refer to the relevant Trouble Shooting chapter. Ascertain whether gland seal leakage is within acceptable limits by a leakage rate check of each gland as detailed in paragraph B. Alternative methods of check using the aircraft feed pumps and the PTIR are given in paragraphs 4 and 5 respectively.

B. Check of Gland Seal Leakage Rate.

When a check of the leakage rate of shaft gland seals is required, install drain adapters on the first stage pump and second stage pump gland seal drain outlets and collect and measure leakage from the gland seals.

(1) PE.29969 - drain adapter. Install on second stage pump (fuel/air) drain outlet (Ref.para.6.B.(8)).

(2) PE.29971 - drain adapter. Install in first stage pump gland drain connection (Ref.para.6.B.(7)).

(3) With engine running at idle, collect gland drainage from each of the three drain tubes over a measured time.

(4) Assess leakage rate. Maximum acceptable gland seal leakage rates:

First stage pump	-	10 cc/min
Second stage pump, fuel/air drain	-	10 cc/min
FCU	-	10 cc/min

4. Leak Check Using Aircraft Fuel Feed Pumps

A. General.

Leak checks, using fuel feed pump pressure, are effective up to the reheat fuel controller shut-off valve and either the HP shut-off valve in the FCU or, when the

outlet connections are blanked, to the distribution and dump valve.

The reheat fuel injection system and engine fuel manifold connections cannot be checked using feed pump pressure.

A leak check using fuel feed pump pressure is always required for a final check of engine to aircraft fuel connections after engine installation, after reconnection of the fuel system following use of the pressure test and inhibiting rig and also as a check of effective closure of bleed and drain valves after their use.

Aircraft connections and servicing points are leak checked as detailed in paragraph B. Leak checks of the fuel system or part of the fuel system are carried out in a similar manner following the detailed procedure given in paragraph C.

B. Leak Check of Aircraft/Engine Connections After Installation or Reconnection of Servicing Points.

(1) Prepare for pressure test.

(a) Pressure test the aircraft to recirculation valve connection (Ref.28-21-00, Adjustment/Test) concurrent with this test if the connection has been disturbed.

(b) PE.20748 - drain adapter. If aircraft/engine fuel system connection has been disturbed, remove fluid passage bolt from seal failure drains system connection at inlet elbow and install the
R drain adapter. On engines to S.B.OL593-71-10
R standard before removing fluid passage bolt,
R detach seal drain tube.

NOTE: After a pressure test of the system using the test rig, the drain adapter would have been left installed in the fuel inlet elbow drain connection.

(c) Ensure that drain valve pressure caps at the inlet elbow and fuel heater and filter are off for the leak check.

(d) Connect bleed tube to the air bleed valve and direct free ends of drain tubes into a drainage container.

(e) Disconnect seals drains system at any point

where a specific leak check is required.

(5) Pressurize and leak check valves, blanking ferrules and connections.

(a) Remove the safety clip and reset the LP fuel isolation valve circuit breaker (Ref.Table 502).

(b) Ensure that all fuel connections are secure, open the LP fuel valve and start the appropriate aircraft fuel feed pumps.

(c) Bleed all air from the system via the air bleed valve. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valves, blanking ferrules and the drains outlets of the aircraft/engine connections under test. No leaks are acceptable.

(e) On completion of check, switch off the aircraft feed pumps.

(6) Restore engine to flight standard.

(a) If installed, remove the drain adapter PE.20748 from the inlet elbow, apply lubricant A and connect the seal drains system. Assemble a new seal washer to each side of the connector and secure in position with the fluid passage bolt torque-tightened to between 150 and 170 lbf in. (17
R and 19,2 N.m). On engines to SB.OL.593-71-10
R standard connect seal drain tube to fluid passage
R bolt and triple torque-tighten thrust wire type
R union nut (Ref.70-00-04, Torque Loading Data) to
R between 90 and 100 lbf in. (10,2 and 11,5 N.m).
R Wire-lock bolt and union nuts.

(b) Ensure that seal is in place and assemble the dust cap to the air bleed valve and tighten the cap.

(c) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valves and tighten the caps.

(d) Wire-lock fluid passage bolt and the three

caps.

(e) Close engine bay doors (Ref.71-00-00 Servicing).

C. Leak Check of Fuel System Upstream of Shut-off Valves.

(1) Prepare for pressure test.

(a) If not previously done, disconnect drains system from drains outlet of each component to be tested.

(b) Connect bleed tube to the air bleed valve and direct tube free end into a container.

(2) Pressurize the system and check for signs of leakage.

(a) Pressurize the system as detailed in paragraphs B.(5)(a), (b) and (c).

(b) With fuel feed pump pressure applied, check for signs of leakage at drains outlets and connections requiring check. Refer to the relevant Adjustment/Test and Trouble Shooting chapters for details of tracing leaks from a component.

(c) Use the press to test valve facility and ascertain if gland seal leakage is excessive (Ref.12-25-12). If possible gland seal failure is indicated, check the leakage rates as detailed in paragraph (3) and ascertain which gland is affected. Alternatively, leakage rates can be determined, either by an engine run (Ref.para.3. B.) or, by use of the pressure test rig (Ref. para.5.).

(3) When a check of the leakage rate of shaft gland seals is required, install all drain adapters at the drains outlets and collect and measure the leakage for each gland seal.

(a) PE.29969 - drain adapter. Install on second stage pump (fuel/air) drain outlet (Ref. para.6.B.(8)).

(b) PE.29971 - drain adapter. Install in first stage pump gland drain connection (Ref. para.6.B.(7)).

(c) Pressurize the system and, with fuel feed pump pressure applied, collect gland drainage from each of the three drain tubes over a measured time.

(d) Assess leakage rate. Maximum acceptable gland seal leakage rates:

First stage pump	-	10 cc/min
Second stage pump, fuel/air drain	-	10 cc/min
FCU	-	10 cc/min

(4) On completion of leak check, restore the engine to flight standard.

(a) Ensure that seal is in place and assemble the dust cap to the air bleed valve and tighten securely. Wire-lock dust cap.

(b) Connect any drains system tubes detached for leak check as detailed in the relevant component chapter or in the Removal/Installation procedures of 71-73.

D. Leak Check of Fuel System Downstream of HP Shut-off Valve for Distribution and Dump Valve.

(1) Prepare for pressure test.

(a) If not previously done, disconnect drains system from drains outlet of each component to be tested.

(b) Connect bleed tube to the air bleed valve and direct tube free end into a container.

(c) PE.35092 - blank and PE.35065 blank/bleed valve. Install items in outlet connection of distribution and dump valve as detailed in paragraph 6.B.(10).

(d) If a check of dump valve leakage source is necessary, install the drain adapter and collect the leakage.

R (d1) PE.27080 - drain adapter. Install adapter in distribution and dump valve dump outlet as detailed in paragraph 6.B.(11).

R (e) Electrically isolate the T1 PROBE HEATER circuit

R R R breaker (Ref. Table 501) by tripping the breaker affecting the engine upon which work is to be carried out. Attach safety clips.

R R R R R R R R R WARNING: WHENEVER ENGINE HP CONTROL CIRCUIT BREAKER IS TO BE TRIPPED OR HP VALVE SWITCH IS SET TO OPEN, FIRST TRIP ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER AND PREVENT UNNECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMPERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
R R Engine No. 1 T1 PROBE HTR SUP	13-215	1H542	C 9
R R Engine No. 2 T1 PROBE HTR SUP	14-215	2H542	E 8
R R Engine No. 3 T1 PROBE HTR SUP	14-216	3H542	C14
R R R Engine No. 4 T1 PROBE HTR SUP	13-216	4H542	C11

R R Circuit Breakers
Table 501

(2) Pressurize the system as detailed in paragraph B.(5) and check for leaks between the HP shut-off valve and the distribution and dump valve outlet connections. For details of tracing and assessing leaks, refer to the Adjustment/Test and Trouble Shooting chapters relevant to the component.

(a) Select the HP VALVE switch OPEN and energize the start solenoid valve.

(b) Bleed air from the system by means of the bleed valve in the blank/bleed valve installed in the distribution and dump valve outlet connection.

(c) When system is free of air close valve.

(d) Check for signs of leakage and ascertain if dump valve leakages are excessive if adapter is installed.

(3) On completion of leak check, restore the engine to flight standard.

(a) If installed for leak check, remove drain adapters (Ref.para.6.D.(10) and (11)).

(b) Install bleed valve dust cap and connect drains tubes (Ref.para.C.(4)).

R (c) Remove safety clip and reset circuit breaker
R (Ref. Table 501).

5. Leak Check the Engine Fuel System Using Pressure Test and Inhibiting Rig (PTIR)

A. General.

A low pressure test must precede both medium and high pressure tests and a close watch for signs of leakage be maintained throughout the procedure.

For convenience, the fuel system is considered as in three sections that are either tested together as a full system or separately according to the leak check to be
R carried out (Ref. Table 502)(Ref. Fig. 501).

Leak checks need only be performed on seals and units which have been affected by the work done. Refer to the component Adjustment/Test procedure for details of a localized check of this type.

Section	Extent of Test	Application
1	Upstream of FCU and reheat controller shut-off valves. (Ref.para.7.B).	Can be done separately from Section 2.
2	Upstream of reheat controller shut-off valve and distribution and dump valve. (Ref.para.7.C).	Test rig connections involve Section 1.

NOTE: Section 1 must be pressurized for a test of Section 2 and can therefore be checked at the

Section	Extent of Test	Application
	same time.	
3	Downstream of reheat controller to spray ring elbow. (Ref.para.7.D).	Sections 1 and 2 not involved.
Test Points	Aircraft/engine and test connections upstream of shut-off valves. (Ref.para 4.B.).	Test pressure provided by aircraft feed pumps.

NOTE: The fuel tubes, manifolds and atomizing nozzles downstream of the distribution and dump valve outlets, cannot be pressure tested.

Pressure Test Application
Table 502

6. Pressure Test and Leak Check of Full System

A. Prepare for Test Sequence.

(1) Open engine bay front and rear lower doors of an installed engine (Ref. 71-00-00, Servicing).

(2) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
Engine No.2			
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19
Engine No.3			
LP VALVE SUP 1	15-216	3Q1	F1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LP VALVE SUP 2	15-215	3Q2	C20
Engine No.4			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
R Table 503

(3) Electrically isolate the engine additional services
R indicated in Table 503 by tripping the circuit breakers affecting the engine upon which work is being carried out. Attach safety clips.

(4) Drain the inlet section of the system.

(a) Open bleed valve to expedite draining.

(b) Use drain tube PE.34076 (Pre S.B.OL.593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve. Direct free end of drain tube into a container and drain the system upstream of the fuel heater and filter.

(c) When drain ceases, remove the drain tube and close the bleed valve.

(d) Discard drained fuel or inhibiting fluid.

(5) To test the system up to the reheat injection system the spray ring elbow must be blanked with a wax plug

(a) Check that spray ring is not already plugged. (Ref. Fig. 502).

NOTE: A new spray ring would be supplied plugged with wax in readiness for pressure test.

(b) If wax plug is not installed, remove reheat injection system, install a wax plug and re-install the reheat injection system as detailed in 73-12-06, Removal/Installation.

CR 31227/00B

SYSTEM BLANKING POINTS

TEST PRESSURE INPUT

TO PILOT NOZZLES

RECIRCULATION VALVE

ELECTRIC STARTER PUMP

SECTION 1

A/C FUEL SYSTEM

EJECTOR PUMP

DUMP VALVE

FIRST STAGE PUMP

INPUT CONNECTION

INLET ELBOW

OIL COOLER

FLOWMETER

TO FUEL MANIFOLD NOZZLES

HEATER AND FILTER

SECOND STAGE PUMP

INPUT CONNECTION

DISTRIBUTION AND DUMP VALVE

FLOW CONTROL UNIT

SECTION 2

PURGE VALVE

REHEAT INJECTION SYSTEM

FLOWMETER

INPUT CONNECTION

DRAINS TANK

REHEAT CONTROLLER

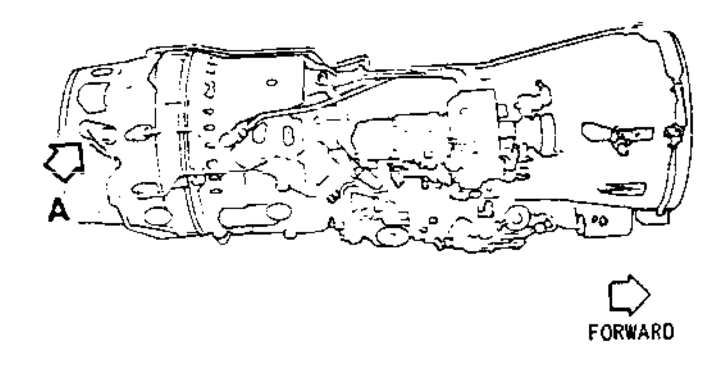
SECTION 3

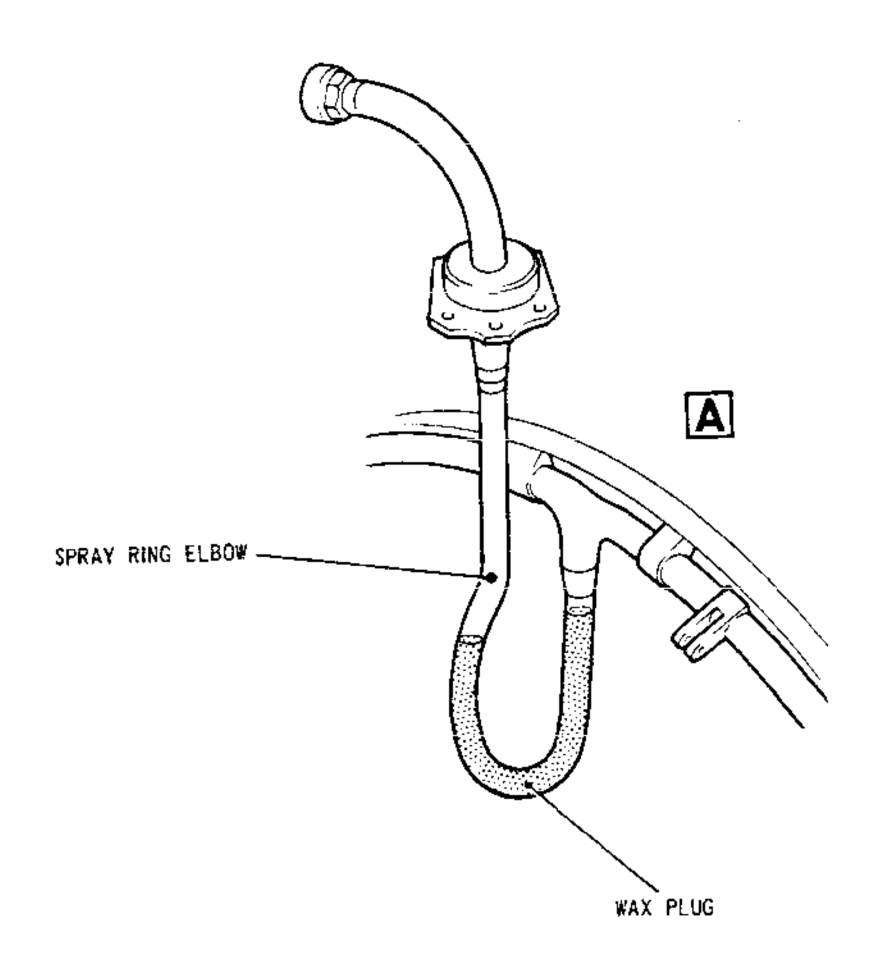
SPRAY RING

CMR 73 00 00 5 AAM0

Schematic Arrangement of Sections and Components
Figure 501

CR 31228/00B





CMR 73 00 00 5 BAMO

Wax Plug Sealing of Reheat Spray Ring
Figure 502

CR 31229/00B

CLAMP

BLANK

FUEL INLET ELBOW

A

B

A

DRAIN VALVE

INLET ELBOW DRAIN
ADAPTER

ADAPTER
SB.73-1

COVER

HOSE ASSEMBLY

SEALING RING

ADAPTER
PRE SB.73-1

THROTTLE VALVE
ACTUATOR GEARBOX

DRAIN ADAPTER ASSEMBLY
(INCORPORATING RELIEF VALVE)

B

CMR 73 00 00 5 CAMA

Installation of Test Equipment in Section 1
(Sheet 1 of 2)
Figure 503

R

CR 32043/00B

E G F

ENGINE DRAINS TUBE-FCU AND FIRST STAGE PUMP

DRAIN ADAPTER

FIRST STAGE PUMP GLAND DRAIN TUBE

BLANKING PLUG

FIRST STAGE PUMP

EJECTOR PUMP OUTLET

ENGINE DRAINS TUBE-FC AND FIRST STAGE PUMP

FIRST STAGE PUMP GLAND CONNECTION

E

EJECTOR PUMP INLET

DRAIN ADAPTER

G

SECOND STAGE PUMP

ENGINE DRAINS TUBE-FCU AND FIRST STAGE PUMP

F

FUEL ATOMIZING PILOT NOZZLE TUBE JUNCTION

DRAIN ADAPTER

BLANKING PLUG

DRAIN ADAPTER

FCU GLAND DRAIN TUBE

ADAPTER BOLT

OUTLET TUBE (SECOND STAGE PUMP FUEL AIR DRAIN)

CMR 73 00 00 5 CAMB

Installation of Test Equipment in Section 1
Figure 503

R

(Sheet 2 of 2)

B. Install Test Equipment (Ref. Fig. 503).

CAUTION: ENSURE TEST EQUIPMENT IS CLEAN AND SERVICEABLE BEFORE INSTALLING ON ENGINE.

(1) PE.20757 - blank and PE.27277 - clamp. Install pressure test blank in the fuel inlet elbow (Ref. Fig. 503) (detail A).

(a) Disconnect aircraft/engine main fuel connection or remove the protective blank from the inlet elbow of an uninstalled engine.

(b) Detach protective cover, ensure blank unit sealing ring is serviceable and press unit into fuel inlet elbow bore.

(c) Position clamp over blank and elbow flanges and tighten securely.

(2) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593 -73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve). Assemble hose and adapter to fuel inlet elbow drain valve location (Ref. Fig. 503) (Detail A).

(a) Pre S.B.OL.593-73-1 drain valve - install adapter PE.22972.

R (a1) Remove attachment bolts and detach drain valve.

R (a2) Insert a serviceable seal plate and secure adapter to elbow at valve location with three bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m) (lubricant B).

(b) S.B. OL.593-73-1 drain valve - install adapter PE.26710.

(b1) Screw adapter securely to drain valve. This action opens the valve.

(c) Connect hose to installed adapter, tighten securely and support with strap.

(3) PE.20746 - drain adapter and PE.29937 - blanking plug (Ref. Fig. 503) (detail E). Install in

return fuel tubes, drains tank to first stage pump/ recirculation valve at inlet and outlet to ejector pump/first stage pump.

(a) Disconnect fuel tube from ejector pump inlet and assemble drain adapter to pump connection. Tighten adapter union nut.

(b) Remove blanking ferrule from return tube test connection, insert blanking plug and retain with connection union nut firmly tightened.

(4) PE.35666 - drain adapter (Ref. Fig. 503) (detail B). Install the throttle valve actuator gearbox spill/drain adapter in the actuator casing. During this operation, keep fluid loss to a minimum so that the actuator remains primed.

(a) Remove drain plug from actuator gearbox rear face.

(b) Remove drain tube from adapter, install adapter with seal washer and tighten firmly.

(c) Assemble drain tube to adapter with seal washer interposed.

(5) PE.20748 - drain adapter (Ref. Fig. 503) (sheet 1). Assemble drain adapter to fuel inlet elbow drain connection.

(a) On engines to Pre S.B.OL.593-71-10 standard, remove seal failure drains system fluid passage pillar bolt and detach connector complete with drain tubes.

(b) On engines to S.B.OL.593-71-10 standard,detach seal failure drains tube from fluid passage bolt, remove the bolt and detach connector complete with drain tube.

(c) Assemble a serviceable seal washer to the adapter and install it in the drain outlet connection.

(6) AS.15826 - blanking unit and PE.29693 - drain adapter (Ref. Fig. 503) (detail F). Install one of the fuel atomizing pilot nozzle tube blanks and the drain adapter ready for the low pressure test.

(a) Detach the two fuel atomizing pilot nozzle tubes

from the junction of the tube from distribution block/dump valve.

(b) Detach clamp assembly securing left-hand tube to support bracket to give clearance when installing adapter.

(c) Screw blank and drain adapter on the tube junction connections and torque-tighten to between 190 and 210 lbf in. (21,5 and 23,7 N.m) with lubricant A applied.

(7) PE.29971 - drain adapter (Ref. Fig. 503) (detail E). Install in first stage pump gland drain connection.

(a) Remove fluid passage bolt from drain connector.

(b) Assemble a serviceable seal washer to each side of connector and secure to pump with adapter torque-tightened to between 210 and
R 230 lbf in. (23,7 and 26 N.m) (lubricant A).

NOTE: Adapter isolates first stage pump gland drain from engine drains tube and provides test drain tube.

(8) PE.29969 - drain adapter (Ref. Fig. 503) (detail G). Install on second stage pump (fuel/air) drain outlet.

(a) Unscrew union nuts and disconnect the two drain tubes from the flanged elbow.

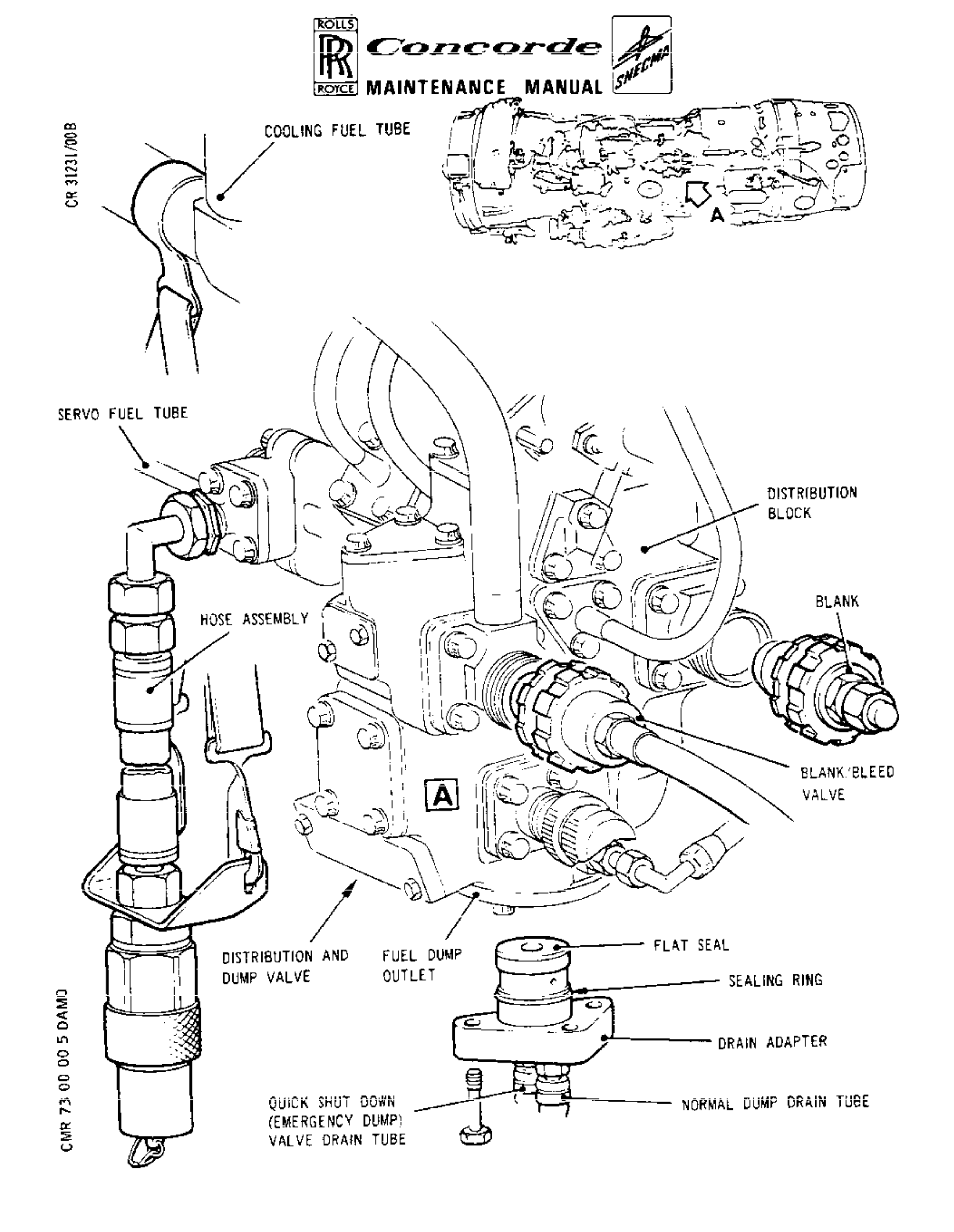
(b) Remove bolts and detach flanged elbow.

(c) With a serviceable seal plate (Ref.70-00-03, Sealing Devices) secure drain adapter to pump with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m) (lubricant B).

(d) Connect first stage pump and FCU gland drain tube to union connection on drain adapter and tighten union nut firmly.

NOTE: Adapter changes common drains passage of flanged elbow to two separate drain outlets to test drain tubes.

(9) PE.28394 - hose (Ref. Fig. 504). Connect hose to connection on servo fuel tube near connection to



Installation of Test Equipment in Section 2
Figure 504

distribution and dump valve.

(a) Remove blanking ferrule from tube flange.

(b) Engage hook of hose support as shown and adjust the strap so that the hose is supported clear of engine installations.

(c) Attach hose adapter to connection and torque-tighten union nut to between 190 and 210 lbf in. (21,5 and 23,5 N.m) (lubricant A).

(10) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 504). Install blanking units in the fuel outlet connections of distribution and dump valve.

(a) Remove both manifold fuel tube connection blanking ferrules.

(b) Install blanking units in place of ferrules.

(c) Secure each unit in position torque-tightened to between 600 and 660 lbf in. (68 and 74 N.m) (lubricant A).

(11) PE.27080 - drain adapter (Ref. Fig. 504). Install drain adapter in distribution and dump valve outlet.

(a) Remove nut, bolt and flat washer securing tube clamp assembly and electrical lead clamp to support bracket at diffuser case flange.

(b) Remove bolts securing tube flange at distribution and dump valve and detach bracket.

(c) Support tube and unscrew tube union nut at drains tank.

(d) Disengage tube spigot from distribution and dump outlet and remove tube from engine.

(e) Ensure the sealing ring and flat seal are serviceable, assemble adapter to the dump outlet location and secure with three bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m) (lubricant A).

(12) 9970-531-043 - adapter (Ref. Fig. 506)(Detail C).

CR 31232/00C

A

C

FORWARD

WAX PLUG

D

B

PURGE AIR/FUEL TUBE-
PURGE VALVE TO SPHERICAL
JOINT FLANGE

FROM PURGE
VALVE

BLANK

A

B

REHEAT FUEL
SPRAY RING

REHEAT PURGE
SOLENOID VALVE

PURGE AIR TUBE-
SOLENOID VALVE
TO PURGE VALVE

ADAPTER

C

INPUT ADAPTER
No. 1 OR 3 ENGINES

PURGE AIR TUBE-
SOLENOID VALVE
TO PURGE VALVE

REHEAT FUEL
CONTROLLER

ADAPTER

REHEAT
PURGE VALVE

D

INPUT ADAPTER
No. 2 OR 4 ENGINES

CMR 73 00 00 5 EAM0

Installation of Test Equipment in Section 3
(Reheat System)
Figure 505

On engines No.1 or 3 detach purge air tube from purge solenoid valve outlet connection and assemble adapter in tube end.

(a) Disconnect tube from the purge solenoid valve outlet connection.

(b) Attach adapter to tube end and torque-tighten union nut to between 190 and 210 lbf in. (21,5 and 23,7 N.m) with lubricant A applied.

(13) 9970-521-075 - adapter (Ref. Fig. 506)(Detail D). On engines No.2 or 4 detach purge air tube from the reheat purge valve inlet connection and assemble adapter to valve.

(a) Disconnect tube from the reheat fuel controller purge valve air inlet connection.

(b) Connect adapter to purge valve inlet connection and torque-tighten to between 190 and 210 lbf in. (21,5 and 23,7 N.m) with lubricant A applied.

(14) - blank (Ref. Fig. 506)(Detail B). Assemble blank in purge air/fuel tube connector between reheat purge valve and spherical joint flange.

(a) Disconnect the purge air/fuel tube sections at the junction between reheat purge valve and spherical joint flange.

(b) Install blank in end of tube section connected to purge valve and torque-tighten to between 190 and 210 lbf in. (21,5 and 23,7 N.m) with lubricant A applied.

(15) Disconnection of the seal failure drains system tubes at the following positions will provide a more precise check for leaks (Ref. Fig. 506).

(a) Reheat fuel filter drain outlet connection.

(b) The two flexible tubes at connector at reheat flowmeter bracket.

(c) Aircraft drain tube connection.

(16) Direct free ends of tubes into a container.

C. Pressure Test Procedure, Full System (Ref. Fig. 506).

CR 31233 00A

INLET ELBOW DRAIN INCLUDES:- A/C CONNECTION AND ELBOW, DRAIN VALVE AND FUEL TUBE FLANGE SEALS

FIRST STAGE PUMP DRAIN INCLUDES:- PUMP TO HEATER, THERMOMETER AND FUEL TUBE FLANGE SEALS

THROTTLE ACTUATOR DRAIN INCLUDES :- F C U, SECOND STAGE PUMP AND FUEL TUBE FLANGE SEALS.

OIL COOLER FUEL TUBE FLANGE SEALS

T-PIECE

DISTRIBUTION AND DUMP VALVE DRAIN INCLUDES:- MANIFOLD, FLOWMETER AND FUEL TUBE FLANGE SEALS

RECIRCULATION VALVE

FUEL TUBE JUNCTION DRAIN

A

B

C

CONNECTOR

DRAINS TANK

REHEAT FUEL FILTER DRAIN

REHEAT FLOWMETER DRAIN

SEAL PLATE

AIRCRAFT FUEL TUBE SEAL DRAINS TUBE

DRAINS OVERBOARD SPILL

HEATER AND FILTER DRAIN INCLUDES.- FILTER COVER, DRAIN VALVE, PRESSURE SWITCH AND FUEL TUBE FLANGE SEALS

ELECTRIC STARTER PUMP DRAIN

B

A

FLEXIBLE TUBES

CONNECTOR

C

CMR 73 00 00 5 FAMO

Seal Failure Drains System Connections
Figure 506

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple the two self-sealing hoses of the test rig to the installed test adapter hoses at the inlet elbow and the servo fuel tube.

(c) Connect third test rig delivery hose to the test adapter and the purge air tube and tighten the union nut.

(d) Verify that the weight of each hose is supported and that all connections are secure before commencing test procedure.

(e) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and re-commence the test procedure.

(2) Bleed all air from the system and continue with the low pressure test paragraph (3).

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

(b) Section 1 - Install air bleed tube PE.22898, - open the air bleed valve and allow to bleed until an air free fuel flow is obtained and then close the valve. Allow a short settling period and repeat the bleed process to ensure that the second stage pump region is air free and again close the valve and remove air bleed tube.

(c) Section 2 - open bleed valve of manifold blank/ bleed valve and allow to bleed until an air free flow is again obtained and then close bleed valve.

(3) Carry out the low pressure test of all sections.

(a) With 30 psig (207 kPa) pressure applied, check leakage rates from the pilot nozzle system, via

fuel atomizing pilot nozzle tube, and from the ejector pump inlet. Measure leakage from drain adapters. The maximum acceptable leakage rates are as follows:

(a1) Pilot nozzle tube ... ... 5 cc/h

(a2) Ejector pump inlet ... ... 1 cc/min

(b) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage and ensure that the following conditions are met before commencing the high pressure test.

R (b1) Gland seal leakage should be minimal. Compare with high pressure test limits as a guide (Ref.para.(5) (d)).

R (b2) No leakage from the primary static seals is acceptable. If a leak shows from the seal failure drains system, carry out progressive disconnections of drains system and find defective seal(s) by a process of elimination and reference to the relevant component chapter.

NOTE: A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

R (b3) There should be no spill from the throttle actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

R (b4) Check system from reheat controller to spray ring. No leakage is acceptable.

(c) Blank fuel atomizing pilot nozzle tube for further pressure test.

R (c1) Remove drain adapter and install blanking unit AS.15826 torque-tightened to between 190 and 210 lbf in. (21,5 and 23,5 N.m) (lubricant A).

(4) Carry out a medium pressure test of the reheat

system, Section 3.

(a) Operate the test rig and increase the test pressure to 170 psig (1172 kPa).

(b) Apply pressure for at least three minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Reduce test pressure to zero.

(d) On completion of reheat system test, disconnect test rig supply hose from adapter and test rig manifold coupling. Ensure that test rig coupling seals off rig delivery.

(5) When test rig is disconnected from the reheat system, Section 3, continue with a high pressure test of the engine system.

(a) Operate the test rig and increase the test pressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check component seal failure drain connections for signs of leaks. No leaks are acceptable. If a leak is disclosed, carry out progressive disconnections and find defective seal(s) by a process of elimination and reference to the relevant component chapter.

NOTE: A seal drains connection at a component may be interconnected internally to more than one seal, (Ref. Fig. 506). Refer also to Adjustment/Test of the chapter specific to the component.

(d) Maintain the pressure long enough to measure accurately leakage from the installed drain adapters. Use a graduated measuring jar and stop watch. The acceptable limits are as follows:

(d1) First stage pump ... ... 10 cc/min

(d2) Second stage pump (fuel/air drain) ... ... 10 cc/min

(d3) FCU gland drain ... ... 10 cc/min

(d4) Throttle valve spill (actuator gearbox rear face drain).. 100 cc/min

(d5) Quick shut-down (emergency dump) valve... ... ... 20 cc/min

(d6) Manifold (normal) dump valve... ... ... 10 cc/min

(d7) Ejector pump inlet ... ... 10 cc/min

(e) Reduce test pressure to zero and stop pump motor.

(6) On completion of pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hoses. Open the bleed valves to expedite draining.

CAUTION: ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

D. Remove Test Equipment and Install/Connect Engine Components.

NOTE: If an engine is to be inhibited, refer to 70-00-07, Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(1) PE.20757 - blank and PE.27277 - clamp ring (Ref. Fig. 503) (detail A). Remove inlet connection blank and clamp ring and, on an installed engine, reconnect the aircraft/engine main fuel connection (Ref.71-00-12, Removal/Installation). On an uninstalled engine, assemble the transit blank to the inlet connection aperture.

(2) PE.22893 - hose and PE.22972 - adapter (Ref. Fig. 503)(detail A). (Pre S.B.OL.593-73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve).

(a) Unscrew union nut and disconnect hose from adapter at inlet elbow drain valve position,

release support strap and remove hose from engine.

(b) Pre S.B.OL.593-73-1 drain valve - remove adapter and install drain valve.

R (b1) Remove bolts and take off adapter and seal plate.

R (b2) Apply lubricant B to drain valve attachment bolts.

R (b3) Assemble drain valve and serviceable seal plate (Ref.70-00-03, Sealing Devices) to inlet elbow location and retain in position with three bolts. Secure wire-locking washer, attached to pressure cap chain, with outer bolt.

R (b4) Torque-tighten the three bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(c) S.B.OL.593-73-1 drain valve - remove adapter.

R (c1) Unscrew union nut and remove adapter from valve.

(3) PE.20746 - drain adapter and PE.29937 - blanking plug (Ref. Fig. 503) (detail E). Remove adapter and plug, connect tube and install blanking ferrule at ejector pump.

(a) Remove plug and assemble blanking ferrule and union nut to connection on return fuel tube and torque-tighten to between 220 and 240 lbf in. (25 and 27 N.m) with lubricant A applied.

(b) Remove adapter and connect fuel tube to ejector pump inlet and torque-tighten union nut to between 220 and 240 lbf in. (25 and 27 N.m) with lubricant A applied.

(c) Wire-lock both union nuts.

(4) PE.35666 - drain adapter (Ref. Fig. 503) (detail B). Remove adapter and install the blanking plug with a new seal washer in the throttle actuator gearbox rear face location. Torque-tighten to 47 ± 3 lbf in. (5,3 ± 0,3 N.m) and wire-lock it. During this operation, keep fluid loss to a minimum to keep actuator gearbox primed.

(5) AS.15826 - blanking units (Ref. Fig. 503) (Sheet 1). Remove blanks and connect fuel atomizing pilot nozzle tubes.

(a) Remove blanks from fuel atomizing pilot nozzle tube junction.

(b) Apply lubricant A to tube union connections and lubricant B to clamp assembly bolt and nut.

(c) Screw tube union nuts to junction and torque-tighten to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(d) Secure clamp assembly to support bracket with bolt, flat washer and nut torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(e) Wire-lock union nuts.

(6) On an uninstalled engine. PE.20748 - drain adapter (Ref. Fig. 503) (Sheet 1). Remove drain adapter from inlet elbow and connect seal failure drains system as follows:

NOTE: On an installed engine the drain adapter is left in position ready for the final leak check using aircraft fuel feed pumps.

(a) Apply lubricant A to attachment items.

(b) Assemble a new seal washer to each side of the connector, secure in position with the fluid passage bolt and torque-tighten to between 150 and 170 lbf in. (17 and 19,2 N.m).

(c) On engines to S.B.OL.593-71-10 standard connect seal drain tube to fluid passage bolt and triple torque-tighten thrust wire type union nut (Ref. 70-00-04, Torque Loading Data) to between 90 and 100 lbf in. (10,2 and 11,5 N.m).

(d) Wire-lock bolt and union nuts.

(7) PE.29971 - drain adapter (Ref. Fig. 503) (detail E). Remove the drain adapter at the first stage pump, assemble a new seal washer to each side of the drain tube connector and secure to pump with the fluid passage bolt torque-tightened to between 210 and 230 lbf in. (24 and 26 N.m) (lubricant A). Wire-lock bolt.

(8) PE.29969 - drain adapter (Ref. Fig. 503) (detail G). Remove drain adapter from second stage pump, install flanged elbow and connect drain tubes.

(a) Apply lubricant A to union nuts and lubricant B to bolts.

(b) With a serviceable seal plate (Ref.70-00-03; Sealing Devices) between mating faces, secure flanged elbow to pump with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and

(c) Secure tube to drains tank, to flanged elbow connection with union nut torque-tightened to between 600 and 660 lbf in. (68 and 74 N.m).

(d) Secure tube from first stage pump and FCU to flanged elbow with union nut torque-tightened to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(e) Wire-lock union nuts.

(9) PE.28394 - hose (Ref. Fig. 504). Detach hose adapter and install blanking ferrule to connection on servo fuel tube near connection to distribution and dump valve.

(a) Assemble blanking ferrule to connection and torque-tighten union nut to between 190 and 210 lbf in. (21,5 and 23,5 N.m) with lubricant A applied.

(b) Wire-lock union nut.

(10) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 504). Remove test blanking units and install flight standard blanking ferrule in manifold tube connections.

(a) Assemble a blanking ferrule to each of the two tube connections at the distribution and dump valve and torque-tighten the union nuts to between 600 and 660 lbf in. (68 and 74 N.m) with lubricant A applied.

(b) Wire-lock union nuts.

(11) PE.27080 - drain adapter (Ref. Fig. 504). Remove drain adapter and connect fuel dump drain tube.

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(a) Remove drain adapter. Ensure that flat seal remains attached to adapter.

(b) Assemble a new sealing ring to the spigot groove of attachment flange.

(c) Apply lubricant A to tube attachment items.

(d) Position tube and engage spigot squarely with dump outlet of distribution and dump valve and screw union nut on drains tank union hand-tight.

(e) Secure flange, together with support bracket, to dump outlet with the three bolts lightly tightened. Locate the two longer bolts to retain bracket.

R NOTE: If difficulty is experienced in assemb-
R ling and securing flange to distribution
R and dump valve refer to S.B.OL.593-71-
R 8482-20.

(f) Secure tube clamp assembly and electrical lead clamp to bracket at diffuser case flange with bolt, flat washer and nut. Torque-tighten nut to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(g) Torque-tighten tube flange retaining bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m) and union nut to between 310 and 340 lbf in. (35 and 38 N.m).

(h) Wire-lock union nut.

(12) Connect seal failure drains system tubes detached for leakage checks.

(a) Apply lubricant A to union connections and connect tubes at reheat fuel filter drain and the two connections of the connector at the reheat flowmeter bracket.

(b) Triple torque-tighten thrust wire type union nuts (Ref. 70-00-04, Torque - tightening Technique to between 90 and 100 lbf in. (10,2 and 11,3 N.m).

(c) Wire-lock union nuts and fluid passage bolts.

(13) 9970-531-043 - adapter (Ref.Fig. FAMO)(Detail C). On engines No.1 or 3 remove adapter and connect purge air tube to solenoid valve outlet connection.

(a) Remove adapter from purge air outlet tube end.

(b) Connect purge air tube to the purge solenoid valve outlet connection and torque-tighten union nut to between 190 and 210 lbf in. (21,5 and 23,7 N.m) with lubricant A applied.

(c) Wire-lock union nut.

(14) 9970-521-075 - adapter (Ref. Fig. 506)(Detail D). On engines No.2 or 4 remove adapter and connect purge air tube to the reheat purge valve inlet connection.

(a) Remove adapter from reheat fuel controller purge valve

(b) Connect purge air tube to reheat purge valve inlet connection and torque tighten union nut to between 190 and 210 lbf in (21,5 and 23,7 N.m) with lubricant A applied.

(c) Wire-lock union nut.

(15) - blank (Ref. Fig. 506)(Detail B).Remove blank and connect purge air/fuel tube at connector between reheat purge valve and spherical joint flange.

(a) Remove blank from purge air/fuel tube.

(b) Connect tube sections at the junction between reheat purge valve and spherical joint flange and torque-tighten union nut to between 190 and 210 lbf in. (21,5 and 23,7 N.m) with lubricant A applied.

(c) Wire-lock union nut.

NOTE: Wax plug in reheat injection system spray ring will be dispersed when engine is run.

(16) On an installed engine, carry out a final leak check of the aircraft/engine connections and complete the removal procedure as detailed in paragraph 4.B.

(17) On an uninstalled engine, continue as follows:

(a) Assemble pressure caps with new seals to the heater and filter unit and fuel inlet elbow drain valves. Tighten and wire-lock the caps.

(b) Close and torque-tighten the air bleed valve to between 100 and 110 lbf in. (11,3 and 12,4 N.m) (lubricant A). Ensure that seal is in place and assemble dust cap to the valve. Tighten and wire-lock the cap.

7. <u>Leak Check of Sections Separately</u>

A. General.

Refer to Table 502 and (Ref. Fig. 501) to ascertain extent of test on each section. The methods for testing Sections 1, 2 or 3 are given in paragraphs B, C and D respectively, in which are stated the steps of procedure of paragraph 2 applicable to a separate section test.

<u>CAUTION:</u> ENSURE THAT SECTION 3, REHEAT SYSTEM, IS NOT CONNECTED TO TEST RIG WHEN MEDIUM TEST PRESSURE IS EXCEEDED.

B. Section 1, Pressure Test.

(1) Prepare to test section upstream of FCU and reheat controller shut-off valves.

(a) Close the LP fuel isolation valve, trip the circuit breakers and drain the inlet section as detailed in paragraph 6.A, (sub-para.(5) is not applicable).

(2) Install the following items of test equipment as detailed in paragraph 6.B, (Ref.sub-para.(1) to (8) and (14) and (15)).

(a) PE.20757 - blank and PE.27277 - clamp. Install in fuel inlet elbow.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710-adapter (S.B.OL.593-73-1 drain valve).Assemble hose and adapter to fuel inlet elbow drain valve location.

(c) PE.20746 - drain adapter and PE.29937 - blanking plug. Install in the return fuel

tubes at inlet and outlet to ejector pump/ first stage pump.

(d) PE.35666 - drain adapter. Install in the throttle valve actuator gearbox spill/drain plug location.

(e) PE.20748 - drain adapter. Assemble drain adapter to fuel inlet elbow drain connection.

(f) AS.15826 - blanking unit and PE.29693 drain adapter. Install items on fuel atomizing pilot nozzle tube junction connections.

(g) PE.29971 - drain adapter. Install in first stage pump gland drain connection.

(h) PE.29969 - drain adapter. Install on second stage pump (fuel/air) drain outlet.

(j) If applicable, disconnect seal failure drains system tubes at sample points to witness any leakage.

(3) Couple the test rig hose to the installed test adapter hose and pressure test Section 1, using the procedure given in paragraph 6.C.

(a) Carry out the low pressure test.

(b) Carry out the high pressure test and check for leaks at seal failure drains system disconnections and measure leakage rates at installed drain adapters. Ensure that leakage rates are within the stated acceptable limits.

(4) On completion of pressure test, remove the installed test equipment, connect the seal failure drains system tubes as detailed in paragraph 6.D, (Ref. sub-para.(1) to (8)) and return the engine to flight standard.

(5) Carry out a pressure test of the remade fuel system connections as detailed in paragraph 4.B.

C. Section 2, Pressure Test.

(1) Prepare to test section downstream of HP shut-off valve up to distribution block outlet.

NOTE: Pressure is applied simultaneously through

Section 1.

(a) Close the LP fuel isolation valve, trip the circuit breakers and drain the fuel system as detailed in paragraph 6.A. (sub-para.(5) is not applicable).

(2) Install the following items of test equipment as detailed in paragraph 6.B. (Ref. sub-para.(1) to (6), (9) to (11) and (14) and (15)).

(a) PE.20757 - blank and PE.27277 - clamp. Install in fuel inlet elbow.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710-adapter (S.B.OL.593-73-1 drain valve).Assemble hose and adapter to fuel inlet elbow drain valve location.

(c) PE.20746 - drain adapter and PE.29937 - blanking plug. Install in return fuel tubes at inlet and outlet of ejector pump/first stage pump.

(d) PE.35666 - drain adapter. Install adapter in the throttle valve actuator gearbox spill/ drain plug location.

(e) PE.20748 - drain adapter. Assemble drain adapter to fuel inlet elbow drain connection.

(f) AS.15826 - blanking unit. Install a blanking unit on each of the fuel atomizing pilot nozzle tube junction connections.

(g) PE.28394 - hose. Connect to connection on servo fuel tube near connection to distribution and dump valve.

(h) PE.35092 - blank and PE.35065 - blank/bleed valve. Install items in fuel outlet connections of distribution and dump valve.

(j) PE.27080 - drain adapter. Install adapter in distribution and dump valve dump outlet.

(k) Disconnect the two seal failure drains system flexible tubes from connector at flowmeter bracket.

(3) Couple the test rig hoses to the two installed test adapter hoses and pressure test Section 2 using the procedure given in paragraph 6.C.

(a) Carry out the low pressure test.

(b) Carry out the high pressure test and check for leaks at seal failure drains system dis-connections and measure leakage rates from dump valve and quick shut-down valve. Ensure that leakage rates are within the stated acceptable limits.

(4) On completion of pressure test, remove the installed test equipment, connect the seal failure drains system tubes and return engine to flight standard as detailed in paragraph 6.D. (Ref. sub-para.(1) to (6) and (9) to (12)).

(5) Carry out a pressure test of the remade fuel system connections as detailed in paragraph 4.B.

D. Section 3, Pressure Test.

(1) Prepare to test section downstream of reheat controller shut-off valve.

(a) Close LP fuel isolation valve, trip circuit breakers and, if required, blank reheat spray ring with a wax plug as detailed in paragraph 6.A. (sub-para (4) is not applicable).

(2) Install the following items of test equipment as detailed in paragraph 6.B.(Ref.sub-para.(12), (13) and (14)).

(a) 9970-531-043 -adapter. On engines No. 1 or 3 assemble adapter to purge air tube.

(b) 9970-521-075- adapter. On engine No. 2 or 4 assemble adapter to reheat purge valve.

(c) - blank. Assemble blank in purge air/fuel tube.

(3) Connect the test rig hose to the input adapter and pressure test the reheat system, Section 3, using the procedure given in paragraph 6.C.

(a) Carry out the low pressure test.

(b) Carry out the medium pressure test and check for leaks.

(4) On completion of pressure test, remove the test equipment and return engine to flight standard as detailed in paragraph 6.D. (Ref. sub-para. (13),(14) and (15)).

SEAL PLATE - REMOVAL/INSTALLATION

1. General

When a leak from a seal failure drains system connection on
a component is disclosed, rectification may be accomplished
by the renewal of a defective seal plate. The removal and
installation of a seal plate is given as a standard practice
in paragraph 2. The work is considered as being done during
R the course of a pressure test. Details of a typical seal
R plate are given in 71-73-00, Description/Operation.

2. Seal Plate Removal and Installation

A. Remove Seal Plate.

(1) Drain fuel from section where defective seal plate is located or, if connected, ensure that the pressure test rig is off and use the rig facilities to drain the test fluid from the engine fuel system.

(2) Remove the flange attachment bolts of the suspected joint and release any associated bracket.

(3) Withdraw the seal plate from between the joint faces. Obtain sufficient withdrawal clearance to ensure that seal plate material is not left between faces.

B. Install Seal Plate.

(1) Refer to chapter applicable to the removal and installation of the component affected and ascertain the lubricant and torque loading for the joint flange attachment bolts.

(2) Apply lubricant to attachment bolts.

R (3) Insert serviceable seal plate (Ref.70-00-03, Sealing
R Devices) between joint faces and align attachment
R holes. Ensure that seals are not chafed when the
R plate is inserted.

(4) Secure the flange, and any associated bracket, with the bolts tightened to the specified torque loading.

(5) If pressure rig is connected, continue with the pressure test and recheck joint for leaks or carry out a specific pressure test of the joint (Ref. 73-00-00).

DISTRIBUTION - DESCRIPTION AND OPERATION

1. General

The distribution components of the engine fuel system convey the fuel entering at the fuel inlet elbow to the fuel flow controlling components and then to the fuel pressure atomizing nozzle assemblies and to the spray ring of the reheat fuel injection system to be discharged into the combustion systems as shown in the illustration (Ref. Fig. 001).

Fuel distribution between components is by means of rigid metal tubes. These are described and identified in 73-13-00.

Fuel is used as the cooling agent for the engine and integrated drive generator (IDG) lubricating oil. A single oil cooler with two oil circulation systems is used as described in 79-00-00. A recirculation fuel return system is used in conjunction with the fuel-cooled oil cooler to ensure an adequate cooling fuel flow.

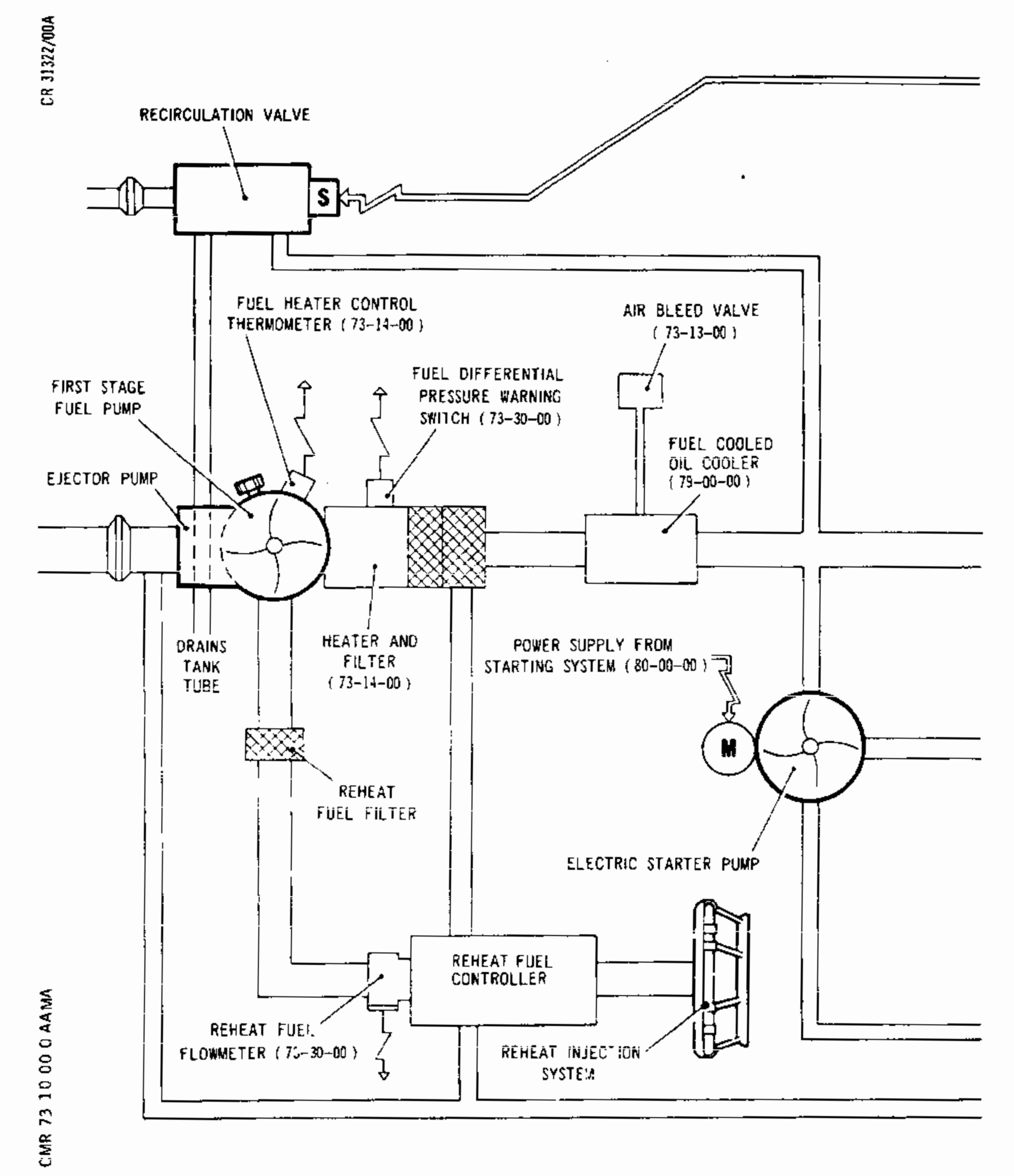
2. Fuel Inlet Elbow and Drain Valve (Ref. Fig. 002)

The fuel inlet elbow is bolted to the first stage pump inlet and provides the connection between the aircraft fuel system and the engine fuel system.

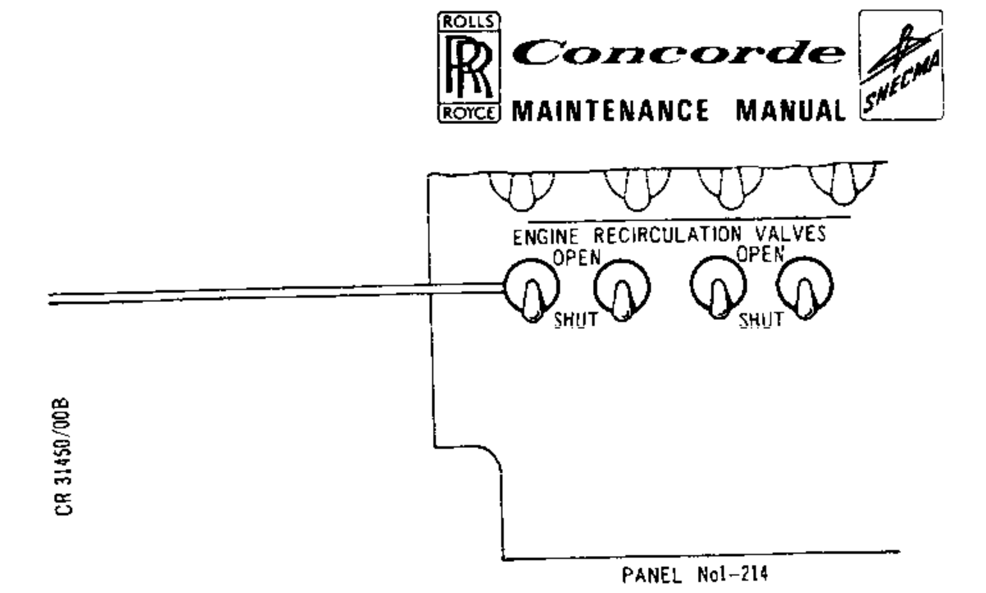
A spigot on the elbow engages the pump inlet bore and locates a seal plate between the joint faces. The elbow is located to the pump inlet by offset attachment holes in the joint flanges. An extension of the elbow flange provides a mounting for three support links for the heater and filter. The elbow has a stepped bore at the front that receives the aircraft fuel system tube spigot carrying two sealing rings. The joint faces are located by two assembly pins and secured by a bolted rim clenching type clamp. Two bolted flange type connections with seal plates provide attachments for the reheat controller and flow control unit (FCU) to first stage pump inlet elbow tube and for a drain valve assembly.

The drain valve assembly consists of a body with a bolted mounting flange, a hollow spring-loaded valve and a pressure cap assembly. The valve, spring-loaded to the closed
R position against a primary seal, is retained in the body by
R a peened locknut. The pressure cap, with a secondary seal,
R is screwed to the body and effects a seal with the mounting
R flange.

Passages in the elbow interconnect the aircraft/engine inlet connection, drain valve joint and pressure cap and the reheat/



Distribution System Schematic (Sheet 1 of 2)
Figure 001



FUEL ATOMIZING NOZZLE ASSEMBLY INLET THERMOMETER (73-30-00)

DISTRIBUTION VALVES

FUEL MANIFOLD AND NOZZLES (MAIN)

SECOND STAGE PUMP

FLOW CONTROL UNIT

H P SHUT - OFF VALVE POSITION TRANSDUCER

MANIFOLD DUMP VALVE

ENGINE FUEL FLOWMETER (73-30-00)

DISTRIBUTION AND DUMP VALVE

PILOT NOZZLES

FUEL DUMP TO TANK

CMR 73 10 00 0 AAMB

Distribution System Schematic (Sheet 2 of 2)
Figure 001

R

FCU tube connection seal drains to a drains outlet connection for the seal failure drains system.

Fuel from the aircraft system is directed by the inlet elbow assembly to the first stage pump. Fuel spill from the reheat controller and FCU enters the side of the elbow and joins the main fuel flow. Fuel leakage from joint primary seals is directed by the internal drain passages to the common outlet to the seal failure drains system. The drain valve allows the front section of the fuel system to be drained and provides an input point for pressure test of the system.

3. First Stage Fuel Pump (Ref. Fig. 003)

A. General

The pump is a high speed, single stage centrifugal unit mounted on the front face of the left-hand gearbox with its splined drive shaft engaging the first stage pump drive and idler gear assembly of the gearbox. A quick attach/detach coupling secures the pump to the gearbox case. The ringnut of the coupling, retained on the gearbox, engages a threaded flange bolted to the mounting face of the pump and is locked by bolted trunnions when tightened.

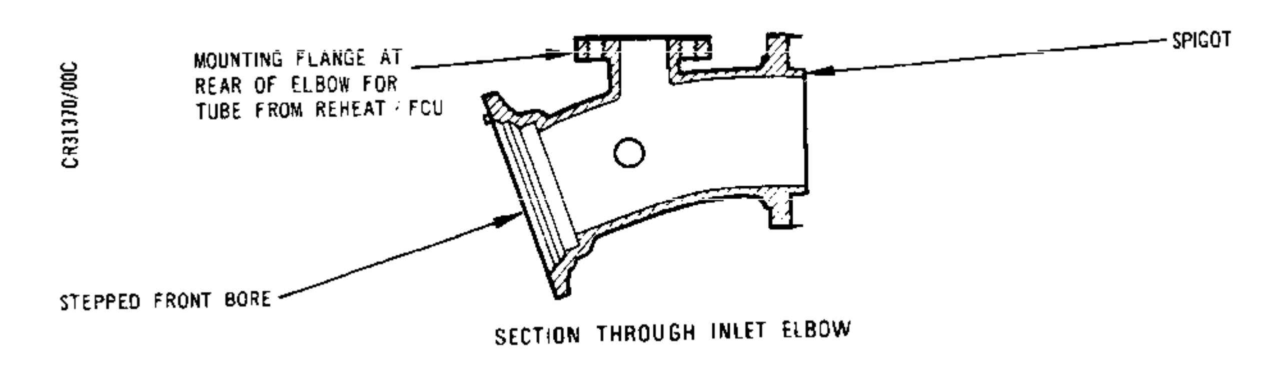
The pump capacity is sufficient to meet engine fuel flow demand from engine light-up to maximum cruise power conditions and reheat fuel demand at maximum engine power conditions. The pump also incorporates a nozzle discharge ejector pump to eject fuel from the engine drains collector tank into the aircraft fuel recirculating system.

B. Centrifugal Pump.

The centrifugal pumping element comprises a shaft driven impeller assembly housed within a bolted-up inducer housing and pump body assembly.

The inducer housing incorporates the fuel inlet port, a static seals fuel drain and a mounting face for the ejector pump, whilst the main fuel outlet port, the reheat outlet port and a face seals drain connection are incorporated in the pump body.

The impeller assembly comprises a six bladed impeller and coupled single start helical inducer secured to a hollow, internally splined shaft. The shaft is supported in an outrigger bearing assembly, housed within the inducer housing, and a cartridge bearing assembly



HEATER AND FILTER SUPPORT LINKS

DRAIN VALVE ASSEMBLY

FIRST STAGE PUMP

INLET ELBOW

SEAL DRAINS CONNECTION

HEATER AND FILTER SUPPORT LINK

CMR 73 10 00 0 BAMO

LOCKNUT

BODY

PRIMARY SEAL

VALVE

SEAL PLATE

MOUNTING FLANGE

SECONDARY SEAL

DRAINS TRANSFER PASSAGE

PRESSURE CAP

SECTION THROUGH DRAIN VALVE ASSEMBLY

R Inlet Elbow and Drain Valve
Figure 002

CR 31323/00E

FUEL TUBE
TO REHEAT SYSTEM

FUEL HEATER CONTRO_
THERMOMETER (73-14-00)

A

PUMP FUEL OUTLET
CONNECTION TO
HEATER INLET

EJECTOR PUMP
OUTLET CONNECTION

GLAND DRAINS
CONNECTION

INLET
ELBOW

A

SEAL DRAINS
CONNECTION

EJECTOR PUMP
INLET

CMR 73 10 00 0 CAMO

EJECTOR PUMP

FUEL RETURN
TO AIRCRAFT
SYSTEM

TO HEATER
AND FILTER

TEMPERATURE
SENSING VALVE

BY-PASS VALVE
AND FILTER

INNER FACE SPRING
SEAL

INDUCER HOUSING

CARTRIDGE BEARING

FUEL INLET

OUTER FACE
SPRING SEAL

OUTRIGGER BEARING

IMPELLER

IMPELLER CARBON RING
AND SEAL ABUTMENT PLATE

FLOW FROM DRAINS TANK
TO EJECTOR PUMP

TO REHEAT
FUEL SYSTEM

FUEL OIL GLAND DRAIN

First Stage Fuel Pump
Figure 003

R

housed within the pump body. Both bearing assemblies incorporate fuel lubricated carbon bearing surfaces.

An externally splined drive shaft, secured within the hollow shaft, transmits the drive from the engine accessory gearbox drive coupling to the impeller assembly. At its driven end, the drive shaft incorporates a thrust and sealing disk. The inner (thrust) face of the disk transmits the thrust loading generated across the impeller assembly to the thrust face of the cartridge bearing assembly, whilst the outer (sealing) face, in running
R contact with non-rotating inner and outer spring loaded
R face seal assemblies, controls the leakage of high pressure
fuel and engine accessory gearbox lubricant respectively.
R The inner face seal is bellows loaded on earlier standard
R pumps.

To reduce the thrust loading carried by the thrust face of the cartridge bearing assembly, internal sealing is incorporated between the impeller face and the pump body as shown. The sealing arrangement comprises a pump body housed, non-rotating (dowelled), seal abutment plate which is spring-loaded into running contact with a carbon ring bonded to the impeller face. The arrangement reduces the area of the impeller face subjected to fuel at pump outlet pressure.

A by-pass valve and filter assembly is housed in the main outlet port of the pump body and the body also provides the location for a thermometer probe, which is part of the fuel heating control system.

Fuel from the aircraft low pressure fuel feed system enters the pump via the fuel inlet elbow and the inducer housing and is accelerated rapidly by the impeller assembly and delivered, at increased pressure, to the main outlet port and to the fuel system control components. When reheat is selected, a proportion of the fuel passes through reheat outlet port to the reheat system control components.

A proportion of the high pressure fuel passing through the main outlet port passes through the filter wall of the valve and filter assembly and is directed into three separate drillings in the pump body. Two of the drillings direct fuel to the cartridge bearing for lubrication purposes, whilst the third drilling transfers fuel to the ejector housing, via a transfer bobbin, to provide the ejector pump drive pressure and the lubrication feed for the outrigger bearing assembly.

To prevent the restriction or total loss of these three fuel supplies in the event of a partial or complete filter blockage, two leaf spring controlled by-pass valves, incorporated in the valve and filter assembly, open when a predetermined pressure drop occurs across the filter.

C. Ejector Pump.

The ejector pump and associated components are contained within an ejector housing and housing cover secured to the inducer housing. The system comprises a jet pump, non-return valve, a strainer and a temperature sensitive flow control, comprising a variable orifice controlled by a stack of bi-metal washers.

The ejector housing incorporates the pump driving pressure inlet connection and the outlet connection to the aircraft fuel recirculating system, whilst the inlet connection from the engine drains tank is incorporated in the housing cover.

The temperature of the filtered high pressure fuel entering the ejector housing and directed to the temperature sensing valve is sensed by the valve bi-metal washer stack. At fuel temperatures below 75 deg C, the stack is sufficiently relaxed to enable the return spring to hold the plate valve in the fully open position. In this condition the fuel passes through the valve orifice to the ejector pump nozzle and is rapidly discharged through the nozzle, creating a depression in the annulus formed between the nozzle and the ejector pump diffuser. This depression causes fuel to be drawn from the engine drains tank through the connecting tube, strainer, non-return valve and diffuser into the annulus, and via the ejector pump outlet adapter to the aircraft fuel recirculating system.

To prevent the discharge of first stage pump high pressure fuel at high temperature into the recirculating system, any increase in fuel temperature above 75 deg C, causes the bi-metal washer stack to expand and progressively close the plate valve against the spring loading. This action progressively reduces the ejector pump nozzle discharge and drains tank ejection rates, until, at a temperature of approximately 95 deg C, the valve is completely closed and discharge, and thus ejection, terminated.

The non-return valve prevents the reverse flow of fuel from the recirculating system into the engine drains tank when the ejector pump is inoperative.

D. Seal Drains Systems.

Any leakage past the face seal assemblies is directed via internal drillings in the pump body to the combined fuel/oil gland drain connection and then by tube to the engine drains tank as described in 71-73-00.

All areas of the unit sealed by sealing and back-up ring combinations and seal plate assemblies incorporate drain drillings between the primary and secondary sealing areas. Any fuel leakage across the primary sealing areas is transferred, via drillings in the pump body and inducer housing, to the inducer housing fuel drain connection and then via the engine seal failure drains system to atmosphere. The transfer of such leakage from the pump body to the inducer housing is via a transfer bobbin surrounding the ejector housing fuel supply transfer bobbin.

4. Fuel Heater and Filter

The fuel heater and filter is mounted on the first stage pump and connects to one of the fuel outlets on the pump volute casing. The fuel tubes to the flow control unit, via the oil cooler, connect to the filter outlet. The unit and its operation are described in 73-14-00.

5. Oil Cooler

The fuel cooled oil cooler provides an internal flow path for the fuel that is directed through the engine and integrated drive generator (IDG) oil sections within the cooler. The unit and its operation are described in 79-00-00.

6. Second Stage Pump (Ref. Fig. 004)

The second stage pump is attached to the fuel flow control unit (FCU) (Ref.Chapter 73-20-00) to boost the output of the first stage pump. Since the output of the first stage pump is sufficient to meet the majority of engine fuel requirements, the second stage pump is inoperative at high altitude or low power conditions.

The fuel output from the first stage pump is directed by the inlet elbow of the second stage pump to the eye of a four bladed centrifugal impeller located in the pump body. Fuel delivery from the impeller passes through a single diffuser to the pump to FCU joint face and thence to the FCU.

The impeller is driven by a single stage axial flow impulse turbine mounted on a common shaft supported in a fuel-cooled

bearing assembly in the pump body.

The turbine is driven by air (P2) bled from the engine LP compressor; turbine speed (hence pump output) being directly controlled by throttling the air supply by means of a butterfly valve located in the inlet of the air casing assembly.

The position of the butterfly valve is determined by an air actuator valve to which it is linked by an external lever on the air casing. The air actuator valve is located on the FCU and its operation is described in 73-20-00 and 73-21-01.

The air casing assembly houses a nozzle and containment ring assembly which shrouds the turbine. The air supply permitted to pass the butterfly valve is directed to the turbine at the required angle by the form of the air casing volute and the nozzle assembly blades.

The air exhaust from the turbine passes to atmosphere through the outer exhaust fairing and five exhaust ports formed between the exhaust restriction plate and the exhaust fairing. The diameter of the exhaust restriction plate determines the exhaust cross-sectional area and thereby determines the turbine maximum speed in the event of malfunction (i.e. butterfly valve stuck open).

Located in the pump body, in parallel with the diffuser, is a non-return valve assembly which will open to reduce the pressure drop that occurs across the diffuser when the second stage pump is inoperative (i.e. impeller stationary).

The bearing assembly consists of a bearing housing containing two carbon journals and two carbon thrust faces. The thrust face and journal at the impeller end of the assembly are fed with fuel passing across the rear face of the impeller. The thrust face and journal at the turbine end of the assembly are fed with fuel tapped from the pump delivery bore in the FCU (via the filter and orifice of the bearing feed assembly). The space in the bearing housing between the two journals is connected by drillings to the FCU and provides the path for the bearing flow return from both journals.

A carbon face seal assembly, located on the turbine end of the bearing assembly and sealing against a drive shaft flange, is used to prevent bearing feed fuel from passing to the turbine. This sealing arrangement is scavenged by air (tapped upstream of the butterfly valve) flowing past the face seal and out through the air/fuel drain on the underside of the pump body.

All joint faces are double sealed with the seal drains and drillings leading to the pump to FCU joint face and thence to

CR 31516/008

AIR DUCT
MOUNTING BOLTS (6 OFF)
FUEL OUTLET TO FCU
FCU
BEARING FLOW RETURN
BEARING FEED
SECOND STAGE PUMP MOUNTING FACE
AIR/FUEL DRAINS CONNECTION

CMR 73 10 00 0 DAMO

P2 AIR
SECOND STAGE PUMP FUEL INLET ELBOW
BY-PASS VALVE
BUTTERFLY VALVE
EXHAUST RESTRICTION PLATE
TUBE ELBOW
FUEL OUTLET TO FCU
BEARING FEED
BEARING FLOW RETURN
TO RECIRCULATION VALVE
FUEL INLET TUBE
TO ELECTRIC STARTER PUMP
FUEL INLET (FROM FSP)
AIR/FUEL DRAIN
AIR EXHAUST
SECOND STAGE PUMP INLET ELBOW
IMPELLER
TURBINE

Second Stage Pump
Figure 004

R

the engine seal failure drains system via the FCU.

7. Distribution and Dump Valve (Ref. Fig. 005)

A. General.

The unit houses the distribution valves, manifold dump valve, quick shut-down (emergency dump) valve, thermometer probe and a transducer to indicate the fuel system HP shut-off valve position. The manifold dump valve outlet is connected, via drillings in the unit, to the quick shut-down, emergency dump, outlet port.

To prevent pressurized fuel spraying into the engine bay from a seal failure, a system of double sealing is used. The annulus between the seals of each double sealed area is connected, through drillings in the unit, to a common drain connection in the base of the unit.

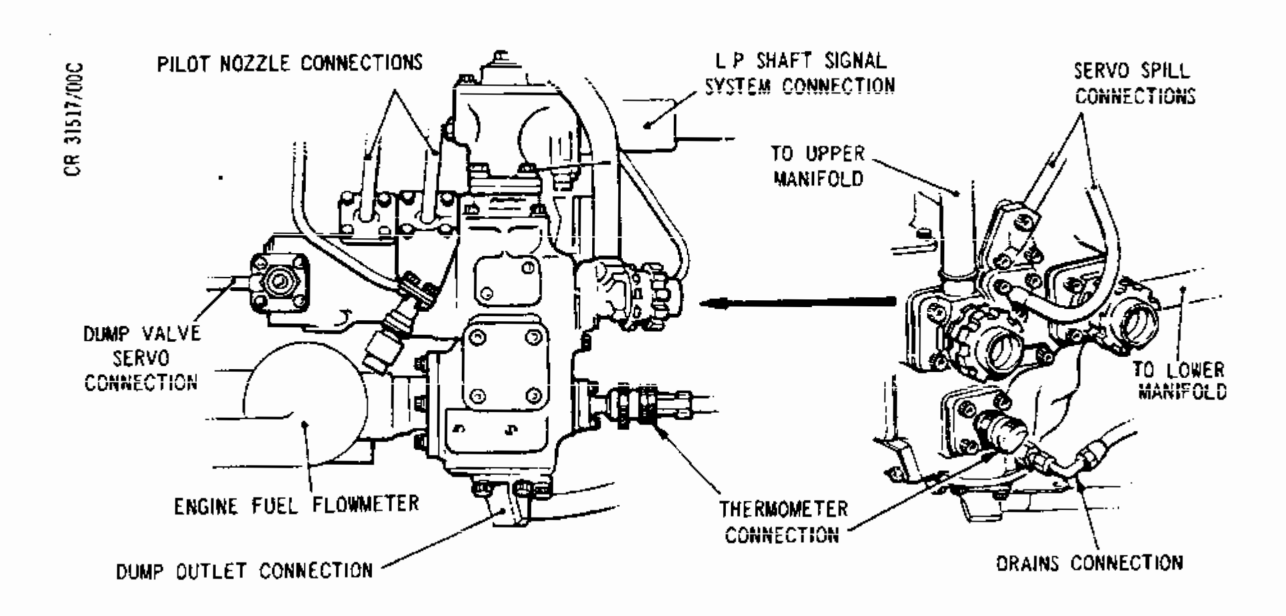
B. Distribution Valves.

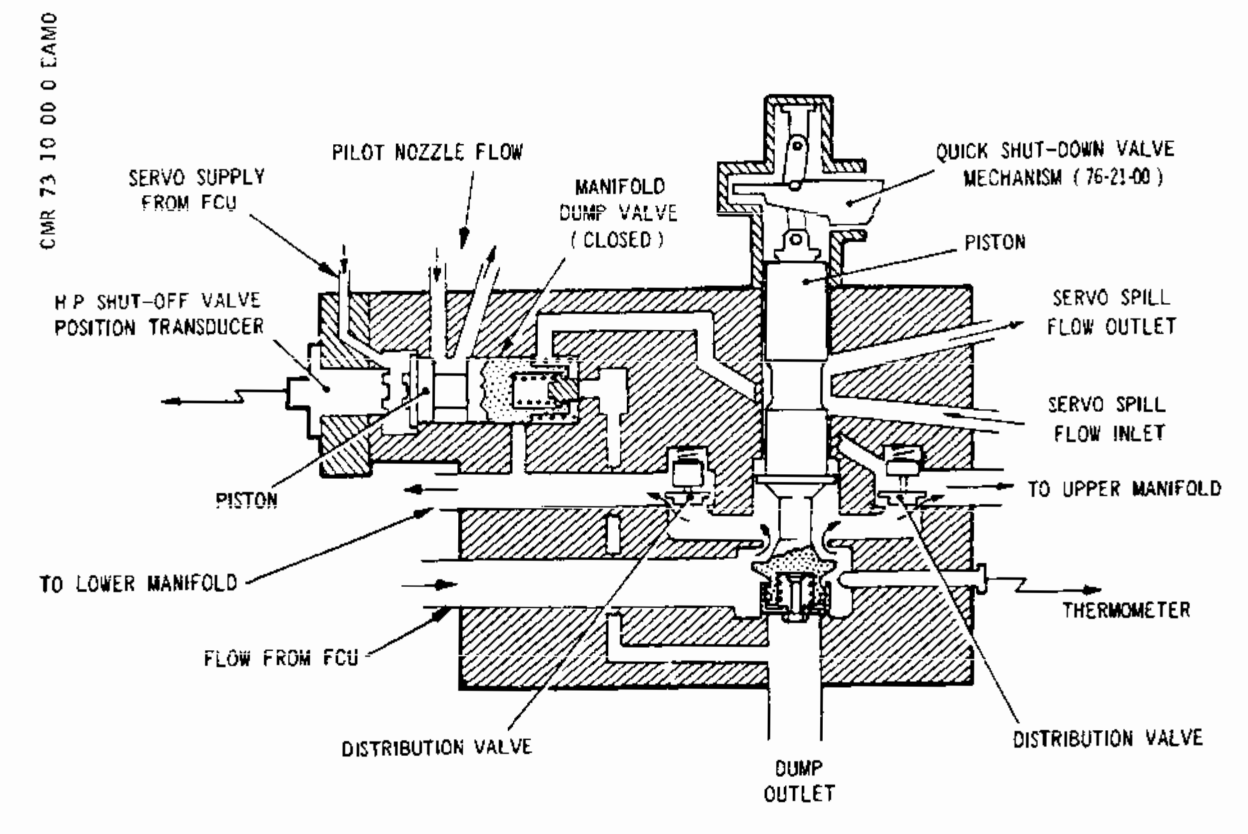
The distribution section accepts fuel flow from the flow control unit (FCU) and divides the flow to supply the upper and lower manifolds of the engine fuel atomizing nozzle assembly. A distribution valve is located in each division, and these valves, of a different weight and spring loading to each other, establish a pressure difference between the two flows to compensate for the difference in head between the two manifolds.

The distribution valves also act as non-return valves and prevent blow back from the engine into the fuel system when dumping occurs.

C. Manifold Dump Valve.

The manifold dump valve provides a means of draining the engine manifolds when the engine is shut down by the operation of the HP shut-off valve in the FCU. The dump valve is held open by spring pressure until the closing sequence is initiated by the opening action of the HP shut-off valve during the engine starting sequence. As the HP shut-off valve opens, a plate valve is opened by the shut-off valve mechanism, as described in 73-20-00, and fuel is passed at throttle valve inlet pressure to the piston end of the dump valve. This pressure moves the piston against the spring force, the dump valve seats and closes the dump outlet. The secondary spring loading of the dump valve permits full travel of the spool and ensures interconnection of the ports serving the pilot nozzle assemblies. Fuel flow from the electric starter pump, energ-





R

Distribution and Dump Valve
Figure 005

ized by the start switch operation, can now pass through the ports to the two pilot nozzle assemblies. The starting fuel flow ceases when the starter pump is automatically switched off by the starting control and is replaced by a small purging flow.

When the HP shut-off valve is closed, the associated mechanism closes the plate valve, which shuts off the flow of throttle valve inlet pressure to the end of the valve piston. The pressure acting on the valve piston is bled away through a restrictor in the FCU and thus permits the valve spring to open the manifold dump outlet. The piston movement also closes the port that interconnects the starter pump to the pilot nozzle assemblies. Aircraft fuel feed pump pressure is isolated from the dump valve ports by a check valve in the starter pump.

D. HP Shut-off Valve Position Transducer.

A transducer is fitted in the end of the manifold dump valve locating bore and a plunger is screwed into the end of the valve piston. When the valve piston moves in response to the changed position of the shut-off valve, the plunger is moved in or out of the magnetic field of the transducer, which sends an electrical signal to change the flight compartment indication of shut-off valve position.

E. Quick Shut-down (Emergency Dump) Valve.

The quick shut-down valve is incorporated to shut down the engine rapidly in the event of an engine LP shaft failure. The engine LP shaft signal system operates as described in 76-20-00 to effect a linear movement of the operating plunger mechanism of the quick shut-down valve.

Movement of the operating plunger operates a toggle mechanism which raises the quick shut-down valve piston to redirect fuel flow from the FCU to the dump outlet. At the same time, the new position of the valve piston closes the spill line from the spring side of the shut-off valve piston, which causes the pressure there to rise to throttle valve inlet pressure; this increased pressure closes the shut-off valve.

F. Temperature Probe.

An aperture is provided in the unit, in which a thermometer probe is installed to provide a flight compartment indication of fuel temperature.

8. Fuel Manifold (Ref. Fig. 006)

The fuel manifold encircles the engine and delivers the fuel received from the distribution and dump valve equally to the eight fuel atomizing (main) nozzle assemblies. The manifold is in two sections, an upper and a lower, that join on each side of the engine by union connections which have ferrules with restricted bores. Each manifold section has four outlet connections which are secured by union nuts to the threaded inlets of the fuel nozzles assemblies. The manifold is further supported by clamp assemblies attached to brackets bolted to the HP compressor diffuser front flange.

The connections for the distribution and dump valve fuel tubes are located centrally on the manifold sections with two nozzles each side. Each manifold section outward of the nozzles nearest the central connection has a reduced bore diameter.

The distributors in the distribution and dump valve compensate for the head difference across the engine and the reduced diameter of the manifold bore maintains the even fuel distribution to the nozzles.

When the engine is shut down, fuel to be dumped drains from the upper manifold into the lower manifold via the restricted bores in the ferrules of the interconnecting unions. The restrictions prevent the manifold fuel delivery pressure differential being affected when the engine is running. Fuel in the manifolds and their fuel tubes drains through the distribution and dump valve via its open manifold dump valve to the dump outlet. The dumped fuel is conveyed by drains tube to the engine drains tank.

9. Fuel Pressure Atomizing (Main) nozzle Assembly (Ref. Fig. 006)

The eight fuel nozzle assemblies receive fuel from the manifold and deliver it from 16 equidistant spray dispersers into the combustion system vaporizers. The nozzles are mounted on the HP compressor diffuser case and project into the combustion chamber. Each nozzle, where it passes through the diffuser case, is located by two assembly pins and secured by a bolted flange.

The sprayer inlet, threaded for the manifold connection has a diverging fuel passage to form a fuel splitter. Each passage is metered and leads to a branched sprayer tube carrying the mounting flanges. The left and right-hand sprayers from the flanges have spray dispersers at the ends with two tangential

CR 31372/00B

MANIFOLD UNION NUT

NOZZLE TUBES

A

FUEL MANIFOLD

METERED SPLITTER PASSAGES

RESTRICTED BORE IN FERRULE

C

C

FUEL ATOMIZING (MAIN) NOZZLE ASSEMBLY

B

C

INTERCONNECTING UNION

A

SPRAY DISPERSER

FUEL PASSAGES

B

CMR 73 10 00 0 FAMO

Fuel Manifold and (Main) Nozzle Assemblies
Figure 006

R

passages at an angle of 45 degrees to the main bore.

Fuel delivered to the splitter inlet passes through the divergent metered passages to provide an even fuel flow to each branched sprayer. The sprayers direct the fuel into the spray dispersers which spray the fuel into the combustion system vaporizers.

10. Electric Starter Pump (Ref. Fig. 007)

A. General.

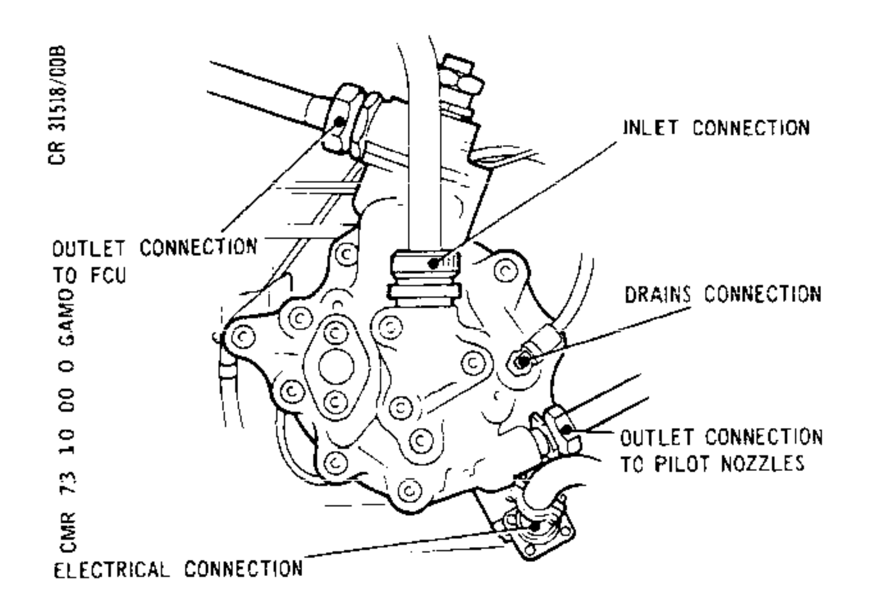
The electric starter pump is bracket mounted below the HP compressor case and has three union nut type connections with the fuel system, one inlet and two outlet. An electrical connection from the engine harness provides for electric power supply.

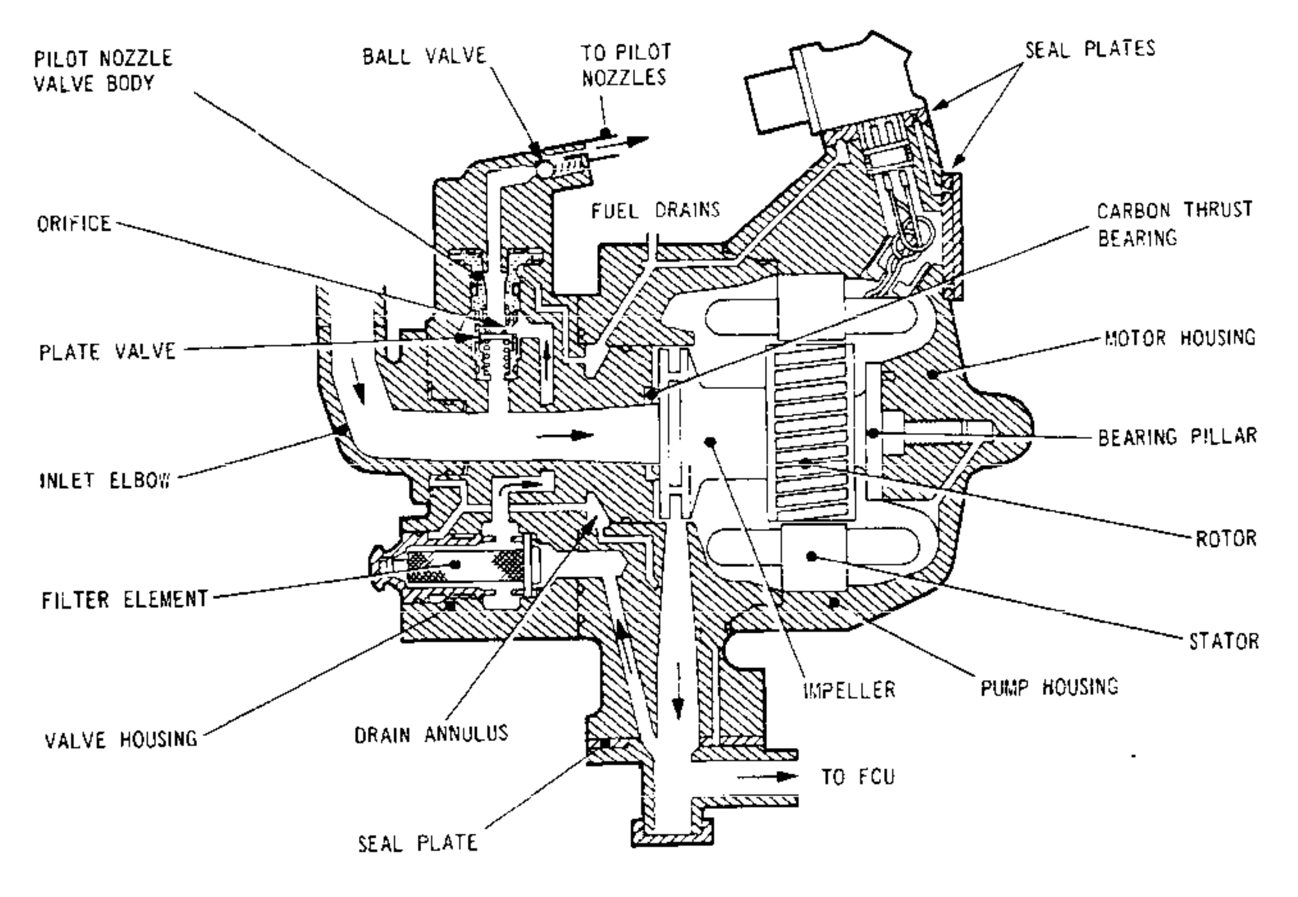
The pump is an electrically driven centrifugal type pump comprising a three phase induction motor, which has an integral shrouded impeller, a pressure sensing valve, and a gauze type filter. These assemblies are contained in three main housings which are identified as the motor, pump and valve housings respectively.

A system of double sealing is incorporated throughout the unit. This ensures that any fuel leakage from housing joint faces or external connections seal plates is contained within the unit and drained away via an external connection to the engine seal failure drains system.

Fuel from the aircraft system, at feed pump pressure, passes through the first stage pump to the starter pump inlet. The fuel enters the impeller and is discharged through a tangential diffuser which is in the form of a single divergent duct terminating at the outlet connection. A pressure sensing tapping from the inlet duct connects to the spring-loaded side of a plate valve in the pilot nozzle valve. A passage for the pilot nozzle fuel supply connects from the outlet mounting face to the orifice outlet side of the plate valve. The gauze filter screens the fuel flow passing to the valve and its orifice.

The pilot nozzle assembly valve comprises a spring-loaded plate valve and an orifice located within a housing. It is supplied with fuel, at starter pump inlet pressure, to the spring side of the valve and starter pump outlet pressure to the orifice side of the valve. During the initial stages of the starting cycle when the engine rpm are low, the first stage pump provides little or no pressure rise.





Electric Starter Pump
Figure 007

R

In this situation, starter pump outlet pressure overcomes the spring and inlet pressure and lifts the plate valve off the orifice and allows the passage of fuel through the opened orifice to the distribution and dump valve. Starting fuel flow from the starter pump to the two pilot nozzle assemblies can then commence when the controlling ports in the dump valve open as described in paragraph 7.C. At the conclusion of the engine starting cycle, the starter pump is switched off and first stage pump pressure, together with the valve spring, closes the valve shutting off the main flow to the pilot nozzle assemblies. A small drilling across the orifice permits a small purge fuel flow to the pilot nozzle assemblies in order to retard the formation of carbon on their atomizing spinners while the engine is running.

A ball valve situated in the fuel atomizing (pilot) nozzle assembly connection acts as a check valve, opening at a fuel pressure slightly above that of the supply from the aircraft fuel feed system. This prevents fuel flowing to the pilot nozzles to spill into the engine combustion chamber by way of the starting pump, when the engine is stationary and the aircraft fuel booster pumps are in operation.

B. Motor Housing.

The motor housing is a dome shaped casting that contains the stator and rotor assemblies which operate totally immersed in fuel. The housing provides the electrical connector mounting and two of the unit installation mounting points.

The stator assembly, consisting of laminations and windings, is a shrink fit in the motor housing; the fit occurring on six longitudinal bars which are welded to the stator laminations.

The rotor assembly consists of an aluminium rotor with a machined extension to which a shroud plate is riveted to form a shrouded impeller. This assembly incorporates a carbon bearing in the form of a sleeve, bonded in the rotor bore; the complete assembly rotating on a central bearing pillar. Thrust bearings at each end of the rotor assembly control axial movement. These bearings take the form of a carbon ring which runs against a hardened steel face. One of the carbon rings is bonded to the valve housing spigot and bears against a steel thrust washer on the impeller. This bearing takes the forward thrust of the rotor assembly during normal running conditions and has a secondary function in controlling the fuel leakage across the impeller eye. A shoulder on the bearing

pillar provides a running face for the second carbon which is bonded to the rotor assembly. This bearing takes the momentary rearward thrust of the rotor assembly during initial rotation, prior to the rotor moving onto the forward thrust bearing under the influence of fuel pressure, and the magnetic field of the stator assembly.

Lubrication and cooling of the carbon bearing, thrust bearings and stator windings is achieved by an induced fuel flow, which originates at the impeller tip and flows past the stator windings and rotor bearings, before re-entering the impeller eye.

This flow is motivated by the difference in fuel pressure between the eye and the tip of the impeller and is restricted by the rotor bearing clearance.

On the exterior of the housing, two raised bosses, tapped and counterbored, provide two of the three unit installation mounting points. Adjacent to one of these bosses is formed a mounting for the electrical connection housing. This mounting contains the stator lead-out wires which are sealed against fuel leakage by means of a pressure sealed connector; seal plates contain any fuel leakage in this area, where it is drained away via drillings to an external drain connection on the pump housing.

C. Pump Housing.

The pump housing is located between the motor and valve housing. It houses the impeller of the rotating assembly which discharges into a tangential diffuser machined in the housing. The diffuser conveys the fuel to the outlet connection.

Also machined in the pump housing is a drilling which terminates at the outlet connection mounting face. This conveys fuel at outlet pressure to the fuel pressure atomizing (pilot) nozzle valve assembly via a gauze filter.

Drillings in the pump housing also connect the outlet connection and electrical connection housing seal plates with a common drain. From here the fuel is conveyed to an external drain connection. The third installation mounting point is located on the pump housing and forms part of the flange, to which the motor housing is attached.

D. Valve Housing.

The valve housing is the smallest of the three housings and contains the pilot atomizing nozzle valve and filter assem-

blies. Removal of this housing facilitates access to the impeller and the rotor assembly.

The pilot nozzle valve comprises a spring-loaded plate valve which seats on an orifice. The plate valve is contained in a detachable housing; this is attached to a body assembly in which the orifice is located. The body assembly is threaded to accept the pilot nozzle connection and when assembled to the unit, this connection retains the complete valve assembly.

The ball valve, fitted in the open end of the fuel atomizing (pilot) nozzle connection prevents fuel flowing to the pilot nozzles under certain conditions, as described in paragraph A. The valve assembly consists of a spring-loaded ball, a stop and adjusting shims fitted inside a cylindrical body and retained in the body by an end cap. A rolled over portion at one end of the body retains the end cap.

The filter assembly is located in the housing at the inlet connection and consists of a gauze type filter fitted into a removable housing. Drillings in the filter location connect with the outlet connection and the valve assembly.

Positioned in the centre of the housing is the fuel inlet duct which conveys fuel from the inlet connection to the impeller eye. This duct terminates in the location spigot of the valve housing which carries a carbon thrust bearing as previously described.

A annular groove is machined on the location spigot; this connects fuel drillings from the inlet and outlet connections, and the pilot nozzle valve and filter asssemblies, to the common drain connection.

E. Seal Drains System.

The electric starter pump incorporates a system of double sealing, which ensures that any internal fuel leakage is contained within the unit. This sealing is achieved using either a seal plate with primary and secondary seals or two sealing rings. Holes drilled in the area between seals allow any fuel leakage to be contained and directed away via drillings to the common external drain outlet on the pump housing.

11. Fuel Pressure Atomizing (Pilot) Nozzle Assembly!
(Ref. Fig. 008)

The pilot fuel nozzle assemblies project through the combustion chamber outer case and deliver an atomized fuel spray into the combustion system during the starting cycle. Each of the two nozzles is located by the side of an igniter and secured by a bolted flange at the bottom centre and bottom left-hand side of the combustion chamber outer case.

The nozzle assembly consists of a body, with an integral spinner body, and a fuel transfer tube calibrated as a matched set. The nozzle body, with a bolted mounting flange, has an external thread for a union connection and, S.B.OL.593-73-13 standard, a short internal thread to retain the transfer tube. The fuel transfer tube, S.B.OL.593-73-13 standard, has a short external thread to retain the tube in the body when screwed through. A spinner body at the nozzle outlet provides for a spinner and disk assembly. The spinner has two tangential passages leading to its centre and is retained in the spinner body by a disk. The disk, with a central orifice, provides a cover for the spinner and is secured by a lip formed around the periphery of the spinner body. Two flats on the transfer tube end and an internal thread are provided to facilitate extraction.

On assembly the tube is screwed into the nozzle assembly until the short threads disengage to leave the tube loose in the nozzle body. The tube is located, by a push fit, where it contacts the top and bottom of the nozzle assembly.

Fuel delivered to the nozzle assembly by the distribution and dump valve to pilot nozzle tube is directed to the spinner body by the transfer tube. The fuel passes through the spinner tangential passages which impart a swirl to the fuel as it enters the spinner centre, and passes out through the disk orifice as a spray at an angle of 100 degrees.

12. Fuel Recirculation Valve (Ref. Fig. 009)

A. General.

The recirculation valve is mounted by brackets to the engine rearward of the oil tank. The inlet of the valve connects to the fuel system upstream of the second stage pump and the valve outlet connects to a fuel return tube to the aircraft fuel system.

The valve enables the fuel flow through the fuel cooled oil cooler to be increased by returning fuel to the aircraft system.

The solenoid operated valve functions as an ON/OFF valve in the fuel re-circulation system. A spherical valve,

CR 31371/008

COMBUSTION CHAMBER OUTER CASE
OUTER FLAME TUBE
A
PILOT NOZZLE
IGNITER

NOZZLE BODY
FUEL TRANSFER TUBE
SPINNER BODY
A

SPINNER BODY
TANGENTIAL PASSAGES
DISK
SPINNER

CMR 73 10 00 0 HAMO

Fuel Pressure Atomizing (Pilot) Nozzle Assembly
Figure 008

housed in a sleeve, is spring-loaded against a static seat formed on the adapter. A vent hole in the sleeve is sealed by a steel ball housed in the spring loaded plunger assembly.

B. Solenoid De-energized.

Pressurized fuel acting on both sides of the spherical valve is balanced and the spherical valve, under the influence of the spring, is maintained against its static seat.

C. Solenoid Energized.

Energization of the solenoid draws the plunger assembly away from the sleeve and pressurized fuel in the sleeve chamber unseats the steel ball. Dissipation of fuel in the sleeve chamber through the sleeve vent hole results in a greater fuel pressure acting on one side of the spherical valve than on the other. The action of fuel pressure on the end face of the spherical valve overcomes the opposing pressure imparted by the spring and the spherical valve moves away from its static seat permitting fuel delivery as shown.

D. Seal Drains.

There are two seal drains outlet connections on the valve that interconnect externally to the engine seal failure drains system. The upper connection serves the aircraft fuel return tube to valve connection while the lower connects by internal passages to the remaining joint face seals.

13. Reheat Fuel Injection System

The reheat injection system, (Ref. Fig. 010) consists of a spray ring, anvil and flame holder located in the reheat combustion chamber rearward of the engine exhaust diffuser. The anvil is secured to the front face of the spray ring which is supported by short rods attached to the flame holder. The flame holder is secured and held centrally in the jet pipe by rods attached to lugs on the jet pipe thermocouple unit. The long and short rods are retained to their respective mounting lugs by headed pins.

The spray ring has a series of holes facing toward the anvil for the discharge of the metered reheat fuel flow. A fuel inlet tube, integral with the spray ring, projects through the exhaust diffuser outer case to which it is secured by a ring nut and bolted flange. The fuel supply tube from the reheat

CR 31519/00A

AIRCRAFT FUEL SYSTEM CONNECTION

RETURN CONNECTION FROM EJECTOR PUMP

SEAL DRAINS

FUEL RETURN TUBE CONNECTION

CMR 73 10 00 0 JAMO

PLUNGER ASSEMBLY

BODY

SOLENOID

TO AIRCRAFT FUEL SYSTEM

SOLENOID DE-ENERGIZED

BALL VALVE (SEATED)

SPHERICAL VALVE (CLOSED)

FROM ENGINE FUEL SYSTEM

FLOW FROM EJECTOR PUMP

SOLENOID ENERGIZED

TO AIRCRAFT FUEL SYSTEM

BALL VALVE UNSEATED

SPHERICAL VALVE OPENED

FLOW FROM ENGINE FUEL SYSTEM

Recirculation Valve
Figure 009

controller connects to the projecting spray ring elbow. A pre-chamber with alternative positions to suit the engine installed location, is mounted between the spray ring and the flame holder. A discharge hole in the rear face of the spray ring is centred in the front of the pre-chamber and an arc igniter tip protrudes slightly into it from the side. The rear of the pre-chamber tube opens into the rearward facing concavity of the flame holder.

14. Distribution System Operation

A. General.

The fuel feed system of the aircraft supplies fuel to the first stage pump inlet at feed pressure PX. The engine driven, first stage fuel pump delivers fuel at a pressure PF proportional to engine speed for both the engine fuel system and, when operating the reheat fuel system.

While the engine is operating under cruise conditions and lower engine speed at low altitudes, the engine driven, first stage pump output satisfies the fuel flow and pressure requirement. The pump was designed to cater for the cruise condition and, since very little throttling will be required in this condition, the fuel temperature rise will be minimized.

In the higher power range, the second stage pump is operated to supplement the first stage pump output and meet the increased fuel flow and pressure requirement. The second stage pump air turbine is driven by air ducted from the intermediate case under the control of an air throttle valve. This air throttle acts in response to fuel pressure signals to regulate the pump speed and, consequently, its output pressure as described in 73-20-00. Unless the pressure signal demands pump operation, the air throttle is closed and compressor air is conserved.

The electric starter pump is supplied with filtered fuel from a connection downstream of the oil cooler and provides a metered starting fuel flow PR to the main fuel atomizing nozzles and a light-up fuel flow to the pilot fuel atomizing nozzles in phase with the starting sequence.

B. Fuel Distribution - Engine Running (Ref. Fig. 011).

When the engine is running, the first stage pump delivery PF passes through the heater and filter unit, as described in 73-14-00, and through the fuel cooled oil cooler to the second stage pump inlet. The fuel flow through the pump, by way of the pumping element when the

CR 31659/00B

MOUNTING RODS

FLAME HOLDER

REHEAT FLAME DETECTOR

A

ANVIL

SPRAY RING

SLIDING TUBE

ANVIL

REHEAT IGNITER

FUEL CONNECTION

A

REHEAT IGNITER

PRECHAMBER

REHEAT FLAME DETECTOR

CMR 73 10 00 0 KAMO

Reheat Fuel Injection System
Figure 010

pump is operating or the bypass valve when it is not, is delivered to the FCU inlet at throttle valve inlet pressure PA.

The FCU meters the fuel according to the power demand of the engine power control system described in 76-00-00. The fuel flow leaves the FCU at nozzle line pressure PB and passes through the engine fuel flowmeter to the fuel distribution and dump valve inlet. A servo pressure supply from the FCU is fed to the manifold dump valve of the distribution and dump valve. A servo spill from the HP shut-off valve of the FCU is also directed to the distribution and dump valve.

The fuel flow to the nozzles is divided into two flows by the distribution and dump valve and enters the upper and lower manifolds with a pressure differential to compensate for the difference in pressure head between the two manifolds. The eight nozzles distribute the fuel equally into the vaporizers of the combustion system via the sixteen delivery nozzles.

Distribution for the reheat system commences with first stage pump pressure PF passing, via the reheat filter and the reheat flowmeter, to the reheat fuel controller. When the reheat system is operating, the controller delivers a metered fuel flow, at reheat fuel pressure PFR direct to the spray ring. The fuel is discharged into the reheat combustion chamber via the equally disposed and forward facing holes in the tubular ring.

C. Engine Shut-down - Distribution and Dump Valve Action (Ref. Fig. 012)

When a normal engine shut-down is initiated, the HP shut-off valve closes and the FCU fuel output ceases. At the same time, the FCU servo pressure to the manifold dump valve is cut off and the valve opens. Fuel remaining in the manifolds and fuel tubes drains back through the open dump valve to the engine drains tank.

The quick shut-down, emergency dump valve action is described in 73-20-00.

D. Fuel Distribution - Engine Starting and Reheat Initiation.

During the initial stages of the starting cycle the first stage pump output is low. Fuel at feed pump pressure PX enters the pump inlet and is delivered at starting fuel pressure PR to the pilot nozzles and to the main fuel nozzles via the FCU and distribution and dump valve.

CR 31520 00A

RECIRCULATION VALVE
S
PF
EJECTOR PUMP
PF
FIRST STAGE PUMP
PF
OIL COOLER
HEATER AND FILTER
PF
PF
PX
FROM DRAINS TANK
PF (SERVO)
ELECTRIC STARTER PUMP
PR
M
SPRAY RING
PXS
PF
REHEAT FUEL CONTROLLER
PFR
REHEAT FLOWMETER
REHEAT INJECTION SYSTEM
PR / PRP
PXS

CMR 73 10 00 0 LAMA

Distribution System Diagrammatic
(Sheet 1 of 2)
Figure 011

CR 31521/00B

PX ENGINE FEED PRESSURE
PXS SPILL TO FIRST STAGE PUMP INLET
PF FIRST STAGE PUMP PRESSURE
PA THROTTLE VALVE INLET PRESSURE
PB NOZZLE LINE PRESSURE
PR STARTER PUMP DELIVERY PRESSURE
PRP PILOT NOZZLE PURGE FLOW
PFR REHEAT METERED FUEL

SECOND STAGE PUMP
P2 AIR
PF
PA
PA (SERVO)
QUICK SHUT-DOWN VALVE
DISTRIBUTORS
MANIFOLD AND NOZZLES (MAIN)
PB
PB
PB
FUEL CONTROL UNIT
PR
PA
DUMP VALVE
ENGINE FLOWMETER
DISTRIBUTION BLOCK
PR PRP
PILOT NOZZLES
PXS
DUMP OUTLET TO DRAINS TANK
PR/PRP
PR PRP
PXS

CMR 73 10 00 0 LAMB

Distribution System Diagrammatic
(Sheet 2 of 2)
Figure 011

CR 31522/008

PA (SERVO)
SERVO PRESSURE APPLIED
PA
HP SHUT-OFF VALVE PLATE VALVE OPEN
PB
TO NOZZLES (MAIN)
SPILL FROM HP SHUT-OFF VALVE PISTON
PB
PB
FLOWMETER
PURGE FLOW TO PILOT NOZZLES
ENGINE RUNNING
DUMP VALVE CLOSED
DUMP OUTLET
PRP

PLATE VALVE CLOSED
SERVO PRESSURE SHUT-OFF
MANIFOLD DRAINING
NORMAL SHUT-DOWN
PORT CLOSED
DUMP VALVE OPEN
DUMP TO OUTLET

CMR 73 10 00 0 MAMO

R

Distribution and Dump Valve Action
Figure 012

The starting pressure acts on the FCU to open the HP shut-off valve, close the manifold dump valve in the distribution and dump valve and provide a metered starting fuel delivery at the main fuel nozzles. The fuel delivery to the pilot nozzles via the pilot nozzle valve within the starter pump provides a light-up fuel spray near the high energy ignition plugs.

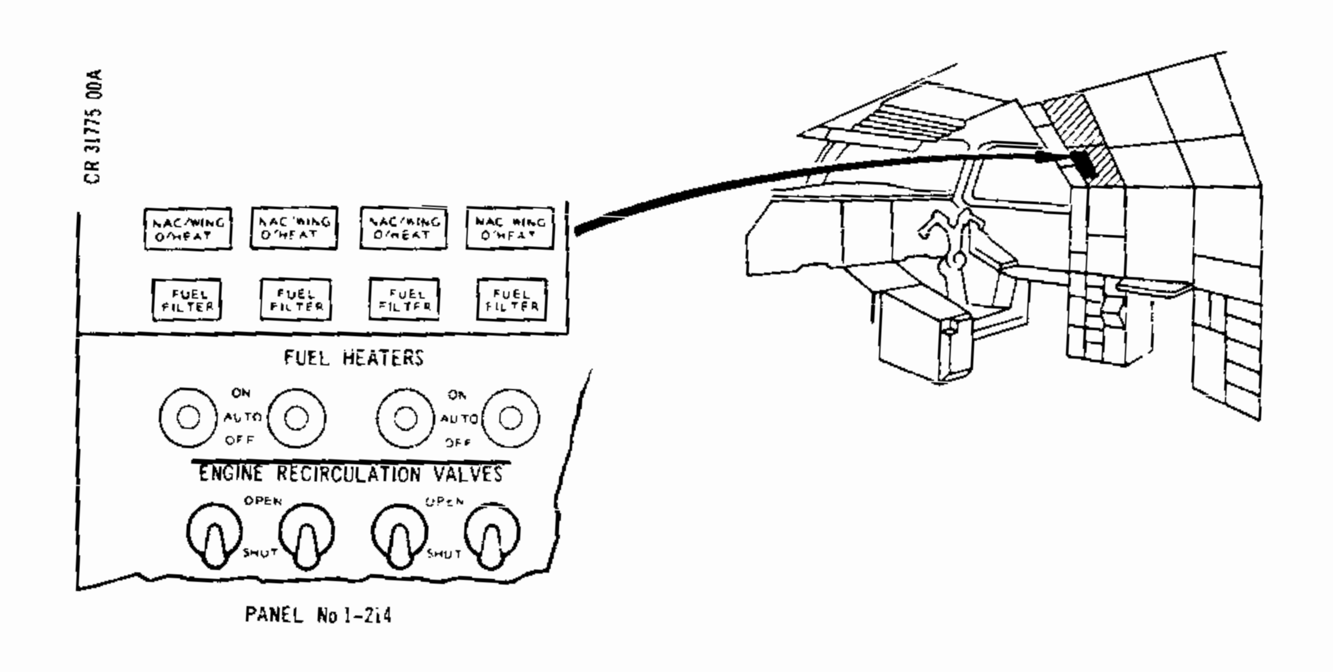
After light-up and as the engine accelerates, the first stage pump becomes more effective and its progressively increasing output pressure becomes dominant. When the first stage pump pressure, supplemented by the spring force of the pilot nozzle valve, exceeds the starting pressure, the valve is closed, starting flow to the pilot nozzles ceases and only a purge flow via a restrictor continues. The starter pump operation continues until the end of the starting cycle, but the first stage pump is meeting the full fuel demand before this time.

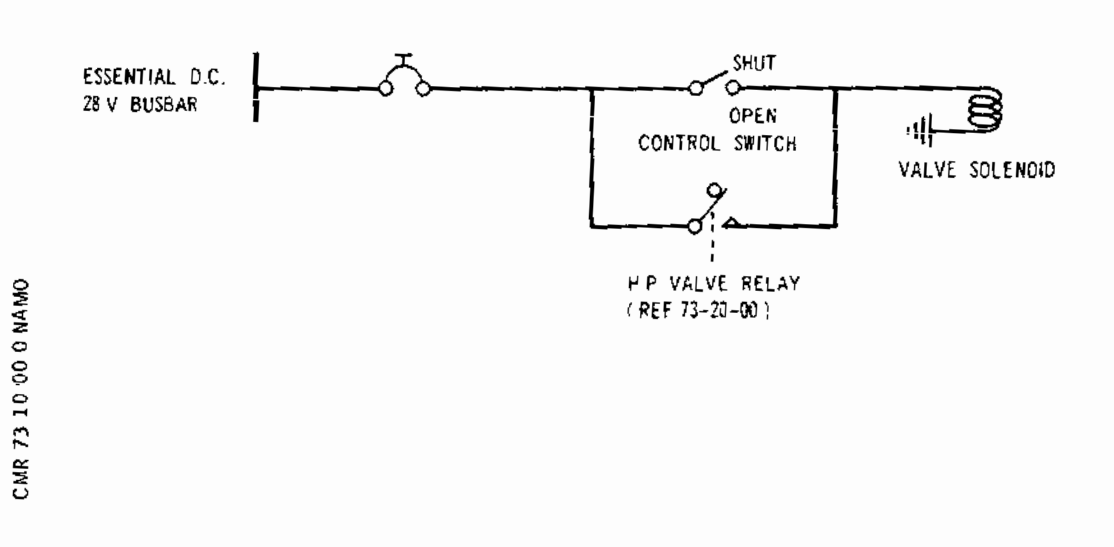
When reheat is initiated, a rearward facing discharge hole in the spray ring delivers a fuel spray into the pre-chamber in which the arc igniter is located. Ignition occurs in the pre-chamber fuel spray which then transmits the light-up to the main fuel spray delivery.

E. Distribution System - Fuel Recirculation.

In the lower engine power range, the fuel flow through the fuel-cooled oil cooler may not be effective in reducing the temperature of the engine and IDG lubricating oil. When excessive oil temperature is indicated, the recirculation valve is selected open by the switch in the flight compartment (Ref. Fig. 013). A return fuel flow then commences from the engine fuel system downstream of the oil cooler to the aircraft fuel system. The increased flow re-establishes effective oil cooling.
Fuel from the aircraft system, at feed pump pressure, passes through the first stage pump to the starter pump inlet. The fuel enters the impeller and is discharged through a tangential diffuser which is in the form of a single divergent duct terminating at the outlet connection. A pressure sensing tapping from the inlet duct connects to the springloaded side of a plate valve in the pilot nozzle valve. A passage for the pilot nozzle fuel supply connects from the outlet mounting face to the orifice outlet side of the plate valve. The gauze filter screens the fuel flow passing to the valve and its orifice.

CR 31775 00A





CMR 73 10 00 0 NAMO

Control Switches and Circuit Diagram
Figure 013

FIRST STAGE FUEL PUMP - REMOVAL/INSTALLATION

1. General

On removal of the first stage pump it is important that the weight (46 lb, 22 kg) of the heater and filter is supported by the strut and support fixture.

Access for removal of the pump can be obtained at the side of No.1 and No.3 engines. On No.2 and No.4 engines, pumps must be withdrawn downward.

The following procedures apply to both pre and S.B.OL.593-
R 72-8458-161, and 73-8306-55, 73-34 standard engines.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Air bleed tube	PE.22898
Drain tube (Pre S.B.OL.593-73-1 drain valve) ...	PE.34076
Drain tube (S.B.OL.593-73-1 drain valve)	PE.26796
Drain tube for heater and filter drain valve ...	PE.21970
Drift, for assembly and removal of quick attach/detach coupling	PE.3778
T-spanner assembly, for quick attach/ detach coupling locking bolt	S3S12348000
Support fixture	PE.35779
Support strut	PE.34355
Circuit breaker safety clip	-

3. Prepare to Remove Pump

A. Open Engine Bay Doors, Isolate Fuel Supply and Electrical Power.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front doors on engines 1 and 3 and engine bay front lower door on engines 2 and 4 (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
FUEL HTR AUTO CONT	15-216	H1331	A11
FUEL HTR IND AND MANL CONT	5-213	H1333	B5
Engine No. 2			
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19
FUEL HTR AUTO CONT	15-215	H1332	E16
FUEL HTR IND AND MANL CONT	1-213	H1334	F8
OIL CONTENTS AND TEMP IND	13-215	2E232	D14
OIL LOW PRESS IND	1-213	2E61	C5
Engine No. 3			
LP VALVE SUP 1	15-216	3Q1	F1
LP VALVE SUP 2	15-215	3Q2	C20
FUEL HTR AUTO CONT	15-215	H1332	E16
FUEL HTR IND AND MANL CONT	1-213	H1334	F8
Engine No. 4			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-
FUEL HTR AUTO CONT	15-216	H1331	A11
FUEL HTR IND AND MANL CONT	5-213	H1333	B5
OIL CONTENTS AND TEMP IND	14-216	4E232	E6

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
OIL LOW PRESS IND	5-213	4E61	A2

Circuit Breakers
Table 401

B. Drain the Engine Fuel and Oil Systems.

(1) Open bleed valve to expedite draining.

(2) Use drain tube PE.37076 (Pre S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE.21970 at the fuel heater and filter drain valve. Direct free ends of drain tubes into a container and drain the system upstream of the FCU.

(3) Loosen reheat fuel tube filter drain nut and allow fuel to drain into container.

(4) When fuel drain ceases, remove the drain tubes and close the bleed valve.On reheat fuel tube, apply lubricant A to blanking ferrule union nut. Torque-tighten nut to between 190 and 210 lbf in. (21,5 and 21,5 N.m). Wire-lock nut to blanking plate.

(5) Drain oil from left-hand gearbox (Ref.72-01-00, Servicing).

NOTE: Discard drained fuel or inhibiting fluid.

C. Disconnect Tubes and Electrical Connections (Ref. Fig.401 and 402).

(1) On No.2 and No.4 engines disconnect hydraulic drain hose self-sealing coupling at nacelle centre wall and restrain hose clear of work area (Ref.71-00-12, Removal/Installation).

(2) Disconnect aircraft/engine main fuel connection and move aircraft tube away from inlet elbow.

R (3) Remove fuel heater to overboard cowling air tube and
R spring housing.

R (a) Unscrew spring housing from end of fuel heater
R air outlet tube.

R R (b) Remove bolts securing tube to bracket and support strut on LP compressor case flange.

R R R (c) Support tube, remove retaining bolt securing tube to heater, and remove tube from heater header outlet duct.

(4) Remove oil container section of main oil pump to oil cooler oil tube assembly.

(a) Remove oil container to upper section tube joint attachment nuts from captive bolts, and detach associated fuel tube support bracket.

(b) Support tube, remove bolts securing tube flange to oil pump and remove tube.

(5) Detach seal failure drains system.

(a) Remove fluid passage bolt securing connector at fuel inlet elbow, on engines to S.B.OL.593-71-10 standard detach seal drain tube before removing fluid passage bolt, and detach connector complete with seal drain tube(s).

(b) Disconnect seal drain tubes from connector and union adapter at pump connection.

(c) Restrain seal drain tubes clear of work area.

(6) Detach drains tank to first stage pump/recirculation valve fuel tubes.

(a) Detach tube from ejector pump outlet and at tube junction union connection and remove tube section.

(b) Detach tube from ejector pump inlet and first union connection and remove tube section.

(7) Remove fluid passage bolt and detach gland drain tube.

(8) Detach the fuel heater control thermometer.

(a) Support thermometer and remove attachment bolts and seal plate.

(b) Support thermometer weight to avoid strain on electrical lead and secure clear of work area.

ADAPTER
CONNECTOR
UNION ADAPTER
A
B
C
CR 31072/008
FUEL HEATER AND FILTER
AIRCRAFT/ENGINE FUEL INLET TUBE
EJECTOR PUMP OUTLET TUBE
FIRST STAGE PUMP
FUEL RECIRCULATION VALVE
FUEL INLET ELBOW
MAIN OIL PUMP
OIL CONTAINER
SEAL DRAINS TUBES
EJECTOR PUMP INLET TUBE
D
E
F
FLUID PASSAGE BOLT
FUEL HEATER AIR OUTLET DUCT
SPRING HOUSING
CMR 73 11 01 4 AAM0
F
PRE S.B. 71-10
FIRST STAGE PUMP
FUEL HEATER CONTROL THERMOMETER
SUPPORT STRUT
FLUID PASSAGE BOLT
F
S.B. 71-10
E
BRACKET
SEAL PLATE
D

Installation Details
Figure 401

R

(9) Remove four attachment bolts from reheat fuel supply tube flange at pump and withdraw seal plate.

(10) Remove four attachment bolts from reheat and FCU return tube at inlet elbow and withdraw seal plate.

D. Remove Inlet Elbow.

(1) Remove support links (Ref. Fig. 403).

(a) Remove long link and its attachment items and retain together.

(a1) Remove bolt securing link to heater.

(a2) Remove nut and flat washer and withdraw bolt and locking plate from lower end of link.

(a3) Remove link and bush assemblies complete, ensuring that the shims are not displaced from bush at upper end of link.

(a4) Remove shims and headed bush, and eccentric bush from link ends.

(b) Remove two short support links and their attachment items and retain each group together.

(b1) Remove bolt securing upper link to heater.

(b2) Remove bolt securing lower link to heater and filter.

(b3) Remove nut, flat washer and bolt securing the upper link to the inlet elbow and remove link with its headed bushes and shims. Separate shims and headed bushes from the link.

(b4) Remove nut, flat washer and bolt securing the lower link to the inlet elbow and remove link with its headed bush and shims. Separate shims and bush from the link.

(2) Remove attachment bolts and detach inlet elbow and seal plate from pump inlet. Retain elbow ready for installation.

E. Support Heater and Filter (Ref. Fig. 404).

CR 31073/008

A

FUEL RETURN TUBE
TO INLET ELBOW

REHEAT FUEL SUPPLY TUBE

FIRST STAGE FUEL PUMP

FUEL DIFFERENTIAL
PRESSURE SWITCH

GLAND DRAIN TUBE

A

FLUID PASSAGE BOLT

CMR 73 11 01 4 BAMO

Fuel Tube Installation and Details
Figure 402

R

(1) Install support assembly.

(a) Turn hand screw of support fixture and bring support block to retracted position.

(b) Engage two location pins at front of support with holes in air outlet duct assembly support bracket, then engage support rear location pin with hole in gearbox mounted bracket.

(c) Adjust hand screw until tool support block engages filter drain valve flange and holds assembly securely.

(2) Continue to support heater and filter and install support strut.

(a) Engage strut bush with support strut location on heater in position indicated.

(b) Assemble slotted end of strut on bush. Engage fork end of strut with LP compressor casing flange and secure with quick release pin.

(c) Assemble washer to bush end shoulder and secure strut fork end with waisted bolt.

(3) On No.2 and No.4 engines, disconnect oil inlet thermometer electrical lead end plug.

(4) Remove bolts and disconnect fuel heater and filter from pump at joint (Ref. Fig. 405).

<u>NOTE:</u> Four bolts are entered downward through the heater flange, and four with flat washers enter upward through the pump outlet flange.

4. <u>Remove Pump Unit from Engine</u> (Ref. Fig. 405)

A. Adjust Support Tool and Release Coupling.

(1) Adjust support tool to raise heater and filter unit until withdrawal clearance is obtained at pump to heater and filter joint flange.

(2) Release quick attach/detach coupling at gearbox/pump connection.

(a) Unscrew and remove bolt, together with spherical washer, from locking trunnion.

B

HEADED BUSH

HEATER AND FILTER

SHIMS

SHIMS

INLET ELBOW

A

HEATER AND FILTER

HEADED BUSH

SHIMS

INLET ELBOW

C

HEADED BUSH

SHIMS

INLET ELBOW

LOCK PLATE

ECCENTRIC BUSH

FLATWASHER

CMR 73 11 01 4 CAM0

Support Link Installation Detail
Figure 403

CR 31174/008

A

STRUT BUSH

SUPPORT STRUT

AIR OUTLET DUCT
ASSEMBLY SUPPORT
BRACKET

GEARBOX MOUNTEC BRACKET

FILTER DRAIN VALVE

A

SUPPORT FIXTURE

CMR 73 11 01 4 DAMO

Support Tool Installation
Figure 404

R

(b) Use the approved drift against flat face of release anvil and drive coupling ring in direction to separate locking trunnions until loosened.

(c) Support pump and turn coupling ring until threads disengage and align with their withdrawal slots.

(3) Withdraw first stage pump squarely from gearbox until assembly pins disengage and then lift pump away. Ensure that mating faces of pump connections are not damaged during withdrawal.

(4) Remove two screws and detach seal plate from pump to heater connection flange.

(5) If pump is to be rejected remove seal drains system multiple connector, union adapter and sealing washers from pump adapter.

R (6) If the pump is not to be re-installed within 48
R hours, it must be inhibited in accordance with the
R instructions detailed in the manufacturers Component
R Overhaul Manual (73-11-01).

5. Install Pump on Engine

A. Prepare to Install Pump.

(1) Transfer drains system items when a new pump is to be installed.

(a) Apply lubricant A to attachment items.

(b) Assemble multiple connector, union adapter and two new sealing washers to first stage pump drains adapter.

(c) Torque-tighten union adapter to between 150 and 170 lbf in (17 and 19,2 Nm).

(2) Check the pump to be installed and its attaching items.

(a) Ensure that quick attach/detach coupling components are serviceable, correctly assembled and secure on mounting faces. Coupling ring and retaining flange renewal procedures are given in 72-62-01, Removal/Installation.

THREADED FLANGE COUPLING
COUPLING RING
SEALING RING
PUMP TO HEATER FLANGE JOINT
SEAL PLATE
LEFT-HAND GEARBOX
FIRST STAGE FUEL PUMP
LOCKING TRUNNION AND CLAMPING BOLT

CR 31071/00A

CMR 73 11 01 4 EAMO

Pump Attachment Details
Figure 405

(b) Assemble a serviceable seal plate (Ref.70-00-03, Sealing Devices) to pump at heater and filter connection flange and secure with two screws. Ensure that screw heads are below face of seal when in assembled condition

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(c) Check that heater and filter support tool setting provides clearance at pump to heater and filter joint flange, established during removal.

B. Install Pump and Fuel Inlet Elbow and Connect Fuel Tubes (Ref. Fig.405).

(1) Assemble pump to gearbox mounting face.

R (a) Lubricate the toroidal sealing ring
R (Ref.70-00-03) and place in groove of gearbox mounted coupling flange face.

(b) Position assembly on gearbox, align assembly pins with their locations and dispose coupling ring with its thread sections facing slots on threaded flange. Position the spherical nut trunnion to tighten to the clamping bolt trunnion when threads are engaged.

(c) Align driving shaft splines, ensure that sealing ring is not displaced, and press assembly squarely in position until joint faces abut.

(d) Turn coupling ring counter-clockwise, in direction to bring trunnions together, and engage threads of ring with those of threaded flange as far as possible by hand.

<u>CAUTION:</u> ENSURE THAT THE THREADS HAVE ENGAGED FREELY BEFORE APPLYING TIGHTENING FORCE TO THE RING.

(e) Position spherical washer on clamping bolt, then insert bolt through fixed locking trunnion to engage threads of spherical nut of coupling ring trunnion by hand.

(2) Tighten the coupling ring in accordance with the procedure given in 70-00-06, QAD coupling - Installation. Use the following locking (run-down) torque and torque-tightening values for the clamping bolt.

(a) Locking (run-down) torque to be within the limit 6.0 and 20 lbf in. (0,68 to 2,26 N.m).

(b) Nominal tightening torque between 170 and 190 lbf in. (19,2 and 21,5 N.m).

(3) Secure the joint flange between pump and heater and

filter.

(a) Apply lubricant B preparatory to torque-tightening bolts.

(b) Bring the heater and filter to its original position with joint flanges/seal plate faces in full abutment. Adjust support tool hand screw as necessary.

(c) Verify that flange alignment is correct and screw in attachment bolts.

NOTE: Four bolts are entered downward through the heater flange and four upward through the pump outlet flange. The four bolts that are entered upward have flat washers fitted.

(d) Torque-tighten the eight bolts evenly, in diametrically opposed pairs to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(e) On engines to Pre S.B.OL.593-73-38 standard, use a 0.0015 in. (0,038 mm) feeler gauge and check for incorrect seating of boltheads.

(f) Carry out the requirements of S.B.OL.593-73-38 at locations where the feeler gauge check has indicated incorrect seating.

(4) Assemble fuel heater control thermometer.

(a) Apply lubricant B to attachment bolts.

(b) Position thermometer with a serviceable seal plate to first stage pump location.

(c) Secure thermometer with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(d) Check that electrical connection lead end plug is connected, tightened and wire-locked.

C. Remove Heater and Filter Support (Ref. Fig. 404).

(1) Remove support strut.

(a) Remove bolt and washer from upper end of strut.

(b) Remove quick removal pin from strut lower end and remove strut and bush.

(2) Remove support fixture.

(a) Turn hand screw clockwise and retract support block until fully clear of filter drain unit.

(b) Withdraw quick removal pin from fork block, disengage location pins and remove support fixture.

D. Install Inlet Elbow (Ref. Fig. 403).

(1) Assemble serviceable seal plate over inlet elbow spigot.

(2) Align attachment holes, inlet elbow drain valve downward, and engage spigot with first stage pump.

(3) Apply lubricant B and insert the six attachment bolts. Torque-tighten bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(4) Connect fuel return tube from reheat and FCU to inlet elbow.

(a) Position serviceable seal plate between tube and elbow mating faces and align attachment holes.

(b) Apply lubricant B then screw in four attachment bolts.

(c) Torque-tighten bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(5) Install the upper short support link (Ref. Fig. 403) (detail B).

(a) Assemble link outer end to inlet elbow.

(a1) Assemble eight shims to headed bush.

(a2) Assemble headed bush to link.

(a3) Apply lubricant B and insert attachment bolt through headed bush, link and inlet elbow then assemble flat washer and nut. Lightly tighten nut.

(b) Assemble link inner end to heater.

(b1) Align attachment holes.

(b2) From set of eleven 0.010 in shims removed with link, select the number required to fill gap between adjacent faces of link and heater.

(b3) Place remaining shims of set over headed bush and assemble bush to link with selected shims between link and heater.

(b4) Apply lubricant B and secure the assembly with a bolt torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(c) Torque-tighten nut on bolt securing link to inlet elbow to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(6) Install the lower short support link (Ref. Fig. 403) (detail A).

(a) Assemble link inner end to heater.

(a1) Apply lubricant B to retaining bolt.

(a2) Insert bolt through link to engage with heater and lightly tighten.

(b) Assemble link outer end to inlet elbow.

(b1) Align attachment holes.

(b2) From set of nine 0.010 in. shims removed with link, select the number required to fill the gap between adjacent faces of link and elbow.

(b3) Place remaining shims of set over headed bush and assemble bush to link with selected shims between link and elbow faces.

(b4) Insert bolt through bush from headed side, assemble washer and nut to bolt. Torque-tighten nut to between 85 and 95 lbf in. (9,6 and 10,7 N.m) using lubricant B.

(c) Torque-tighten bolt securing link to heater to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(7) Install long support link (Ref. Fig. 403) (detail C).

(a) Determine number of shims required between link upper attachment and heater unit.

(a1) Assemble eccentric bush in link lower attachment hole, aligning one slot in bush and link face. Engage lockplate with aligned slots.

(a2) Position link on elbow flange and secure with bolt, washer and nut.

(a3) From set of eleven 0.010 in. shims removed with link, select the number required to fill gap between adjacent faces of link and heater with attachment holes aligned as near as possible.

(a4) Remove link from engine.

(b) Position remaining shims of set not required to fill gap over top attachment headed bush. Insert bush through link top attachment hole with head on same side of link as slots at other end.

(c) Place selected shims to fill gap over bush end. Apply lubricant B to bolt, position link and secure with bolt lightly tightened.

(d) Assemble link lower end to inlet elbow.

(d1) Align holes in link and elbow.

(d2) Engage eccentric bush with link hole and rotate it until it freely engages with attachment hole.

(d3) If a slot in bush does not align with a slot in link face adjust bush to bring two nearest slots into alignment.

(d4) Assemble lockplate with its key engaging slot and insert bolt. Apply lubricant B and assemble flat washer and nut.

(e) Torque-tighten nut on lower attachment bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m) ensuring that lockplate remains in position in slots.

(f) Torque-tighten upper attachment bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

6. Complete the Installation

A. Connect Fuel Tubes.

(1) Connect reheat supply tube at pump.

(a) Apply lubricant B to attachment bolts.

(b) Position serviceable seal plate (Ref.70-00-03, Sealing Devices) between joint faces with attachment holes aligned.

(c) Secure tube flange to pump with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(2) Install drains tank to first stage pump/recirculation valve fuel tubes.

(a) Apply lubricant A to attachment items.

(b) Attach tube between ejector pump outlet and first union connection and lightly tighten union nuts.

(c) Torque-tighten union nuts to between 190 and 210 lbf in. (21,5 and 23,5 N.m) and wire-lock them.

B. Check for Leaks at Connections Disturbed During Procedure

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure - connect the aircraft/engine main fuel connection (Ref. 71-00-12, Removal/ Installation) and then comply with the procedures given in 73-11-01, Adjustment/Test paragraph 2.

(b) PTIR pressure - comply with the procedures given in 73-11-01. Adjustment/Test paragraph 3.

(c) On completion of static pressure test, and removal of any installed test equipment, continue with the installation procedure of paragraph C.

(2) If a leak check is to be carried out during an engine

run, continue with the installation procedure of paragraph C.

C. Continue Installation of Components

(1) Secure gland drain tube to pump.

(a) Apply lubricant A to attachment items.

(b) Assemble new sealing washer at each side of tube connection, assemble fluid passage bolt and engage with pump casing.

(c) Torque-tighten fluid passage bolt to between 210 and 230 lbf in. (24 and 26 N.m), and wire-lock.

(2) Install the drains tank fuel return to ejector pump inlet tube.

(a) Apply lubricant A to attachment items

(b) Connect tube to pump and to first joint.

(c) Torque-tighten union nut at pump to between 220 and 240 lbf in. (25 and 27 N.m) and nut at first joint to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock each nut.

(3) Connect seal failure drains system at first stage pump.

(a) Apply lubricant A to attachment items.

(b) Connect flexible drain tubes to union adapter and multiple connector at pump. Triple torque-tighten thrust wire type union nuts (Ref. 70-00-04, Torque Loading Data) to between 90 and 100 lbf in. (10,2 and 11,3 N.m). Wire-lock nuts and fluid passage bolt.

(4) Connect aircraft/engine main fuel connection (Ref.71-00-12, Removal/Installation), if not already done during a static leak check procedure.

(5) On No.2 and No.4 engines connect, tighten and wire-lock the oil inlet thermometer electrical connection lead end plug.

(6) Install oil container section of main oil pump to oil cooler tube assembly.

(a) Apply lubricant B to attachment items.

(b) Locate new gasket at each end of oil container. Support container with connections aligned, engage with captive bolts in upper tube section and screw nuts, lightly tightened, to six short bolts.

(c) Assemble fuel tube support bracket to the two long bolts at the upper connection and secure with nuts lightly tightened.

(d) Secure container to oil pump with six bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(e) Torque-tighten container to upper section joint attachment bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(7) Secure hydraulic drain hose self-sealing coupling to nacelle centre wall, refer to its checks and installation procedures detailed in 71-00-00.

R (8) Install fuel heater to overboard cowling air tube and
R spring housing.

(a) Apply lubricant B to attachment items.

R (b) Ensure that sealing ring at fuel heater header
R is serviceable and secure.

R (c) Engage tube with heater header outlet duct and
R secure in position with the retaining bolt
R lightly tightened.

R (d) Attach tube, together with suport strut, to
R bracket on LP compressor case flange and with
R two bolts lightly tightened.

R (e) Torque-tighten bolt, tube to header, to between
R 80 and 90 lbf in. (9,0 and 10,2 N.m).

R (f) Torque-tighten bolts, tube to bracket, to between
R 67 and 73 lbf in. (7,6 and 8,2 N.m).

R (g) Check that clearance between the bracket and the
R fuel tube, fuel filter outlet to tube junction,
R is not less than 0.20 in. (5 mm). If the clear-
R ance is not acceptable, refer to S.B.OL.593-75-14
R and 75-8584-18.

R (h) Screw spring housing onto heater air duct outlet and on engines No.2 and No.4, interpose the hydraulic pump flexible drain pipe support bracket (Ref.75-21-12, Removal/Installation).

(9) Connect the seal drains system at the inlet elbow.

(a) Apply lubricant A to attachment items.

(b) Assemble a new seal washer to each side of the connector and secure in position with the fluid passage bolt torque-tightened to between 150 and 170 lbf in. (17 and 19,2 N.m).

(c) On engines to S.B.OL. 593-71-10 standard, connect seal drain tube to fluid passage bolt and triple torque-tighten thrust wire type union nut (Ref. 70-00-04, Torque Loading Data) to between 90 and 100 lbf in. (10,2 and 11,3 N.m).

(d) Wire-lock bolt and each union nut.

(10) Replenish oil system (Ref. 12-13-79, Servicing).

D. Restore Engine to Flight Standard.

(1) If a leak check is to be made during an engine run carry out a preliminary leak check using the aircraft fuel feed pumps.

(a) Remove safety clips, reset circuit breakers (Ref. Table 401) and open the LP fuel isolation valve.

(b) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all air from the system.

(c) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

(e) On completion of check, switch off the aircraft fuel feed pumps.

(2) To complete the installation or prepare for ground

run, install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(3) Remove safety clips, reset circuit bleakers (Ref. Table 401), and open the LP fuel isolation valve.

(4) If the fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing) that are required for the engine run checks, and comply with the procedures of 73-00-00 and 71-00-00, Adjustment/ Test respectively. On completion of engine run retrip circuit breakers and attach safety clips.

(5) Close engine bay doors (Ref.71-00-00, Servicing).

FIRST STAGE FUEL PUMP - ADJUSTMENT/TEST

1. General

This chapter is complementary to the Removal/Installation of the first stage pump and details the procedures for leak checks by application of a static pressure. Paragraph 2
R details the leak checks using the aircraft fuel feed pumps
R and paragraph 3 details the leak checks using the pressure
R test and inhibiting rig (PTIR).

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Leak Check with Aircraft Fuel Feed Pumps

A. General

R The first stage pump and associated connections are leak
R checked, using the appropriate aircraft fuel feed pump,
R in conjunction with the procedures detailed in 73-00-00,
R Adjustment/Test.

B. Tools and Equipment

Air Bleed Tube PE.22898

C. Leak Check First Stage Pump and Associated Connections.

(1) Ensure that connections at drains to be leak checked are detached (Ref.73-11-01, Removal/Installation).

(a) Seal drain tubes at inlet elbow connection.

(b) Seal drain tubes at heater and filter connection.

(c) Tube at ejector pump inlet connection.

(d) Gland drain tube at first stage pump connection.

(2) Apply static pressure and check for leaks.

R (a) Remove the safety clips and reset the LP fuel
R isolation valve circuit breakers (Ref.73-11-01, Removal/Installation, Table 401).

(b) Ensure that all fuel connections are secure, open the LP fuel valve and start the appropriate aircraft fuel feed pumps.

(c) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valves, blanking ferrules and the drains outlets of the aircraft/engine connections under test. No leaks are acceptable.

(e) On completion of check, switch off the aircraft feed pumps.

(3) If any doubt exists whether any leakage rate from the gland drain or ejector pump inlet is acceptable, carry out an accurate leak rate check as detailed in 73-00-00, Adjustment/Test.

(4) If a seal failure drains connection leakage should occur.

(a) Establish the location of the defective seal (Ref. Fig. 502).

(b) Renew a defective seal or component and then repeat the leak check.

3. Leak Check Using PTIR

A. General

This paragraph details the procedure for a pressure test and leak check using the PTIR and pressure test equipment. On completion of the PTIR checks a final leak check is required on an engine using the aircraft fuel feed pumps to check remade connections after removal of test equipment.

B. Tools and Equipment.

Pressure test and inhibiting rig (PTIR)... ... PE.17988

R Pressure test equipment (contained in adapter set PE.29964) are required as follows:

Air bleed tube PE.22898

Adapter (Pre S.B.OL.593-73-1 drain valve) PE.22972

Adapter (S.B.OL.593-73-1 drain valve) ...	PE.26710
Blank	PE.20757
Blanking unit (2)	AS.15826
Blanking plug	PE.29937
Clamp	PE.27277
Drain adapter	PE.20746
Drain adapter	PE.20748
Drain adapter	PE.35666
Drain adapter	PE.29971
Hose	PE.22893

C. Test Fluid.

Aviation kerosine ... ... or	D.Eng.R.D.2494
Inhibiting fluid	DEF.2001A or D.Eng.R.D.2490

D. Install Pressure Test Equipment.

(1) Install the following items of test equipment as detailed for each individual item in 73-00-00, Adjustment/Test para.6.B.

(a) PE.20757 - blank and PE.27277 - clamp (Ref. Fig. 501) (detail A). Install in fuel inlet elbow.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve)(Ref. Fig. 501) (detail A). Assemble hose and adapter to fuel inlet elbow drain valve location.

(c) PE.20746 - drain adapter and PE.29937 - blanking plug (Ref. Fig. 501) (detail E). Install in the return fuel tubes at inlet and outlet to ejector pump/first stage pump.

(d) PE.35666 - drain adapter (Ref. Fig. 501) (detail B). Install in the throttle valve

actuator gearbox spill/drain plug location.

(e) PE.20748 - drain adapter (Ref. Fig. 501) (detail A). Assemble drain adapter to fuel inlet elbow drain connection.

(f) AS.15826 - blanking unit (Ref. Fig. 501) (detail F). Install a blanking unit on each of the fuel atomizing pilot nozzle tube junction connections.

(g) PE. 29971 - drain adapter (Ref. Fig. 501) (detail E). Install in first stage pump gland drain connection.

(2) Direct free ends of drain tubes into a container.

D. Pressure Test Procedure.

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple a self-sealing hose of the test rig to the installed test adapter hose at the inlet elbow.

(c) Verify that the weight of the hose is supported and that all connections are secure before commencing test procedure.

(d) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence the test procedure.

(2) Bleed all air from the system and continue with the low pressure test, paragraph (3).

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

(b) Install air bleed tube PE.22898, open the air bleed valve and allow to bleed until an air free fuel flow is obtained and then close the valve.

CR 31229/00B

CLAMP

BLANK

FUEL INLET ELBOW

A

B

A

DRAIN VALVE

INLET ELBOW DRAIN ADAPTER

ADAPTER SB.73-1

COVER

HOSE ASSEMBLY

SEALING RING

ADAPTER PRE SB.73-1

THROTTLE VALVE ACTUATOR GEARBOX

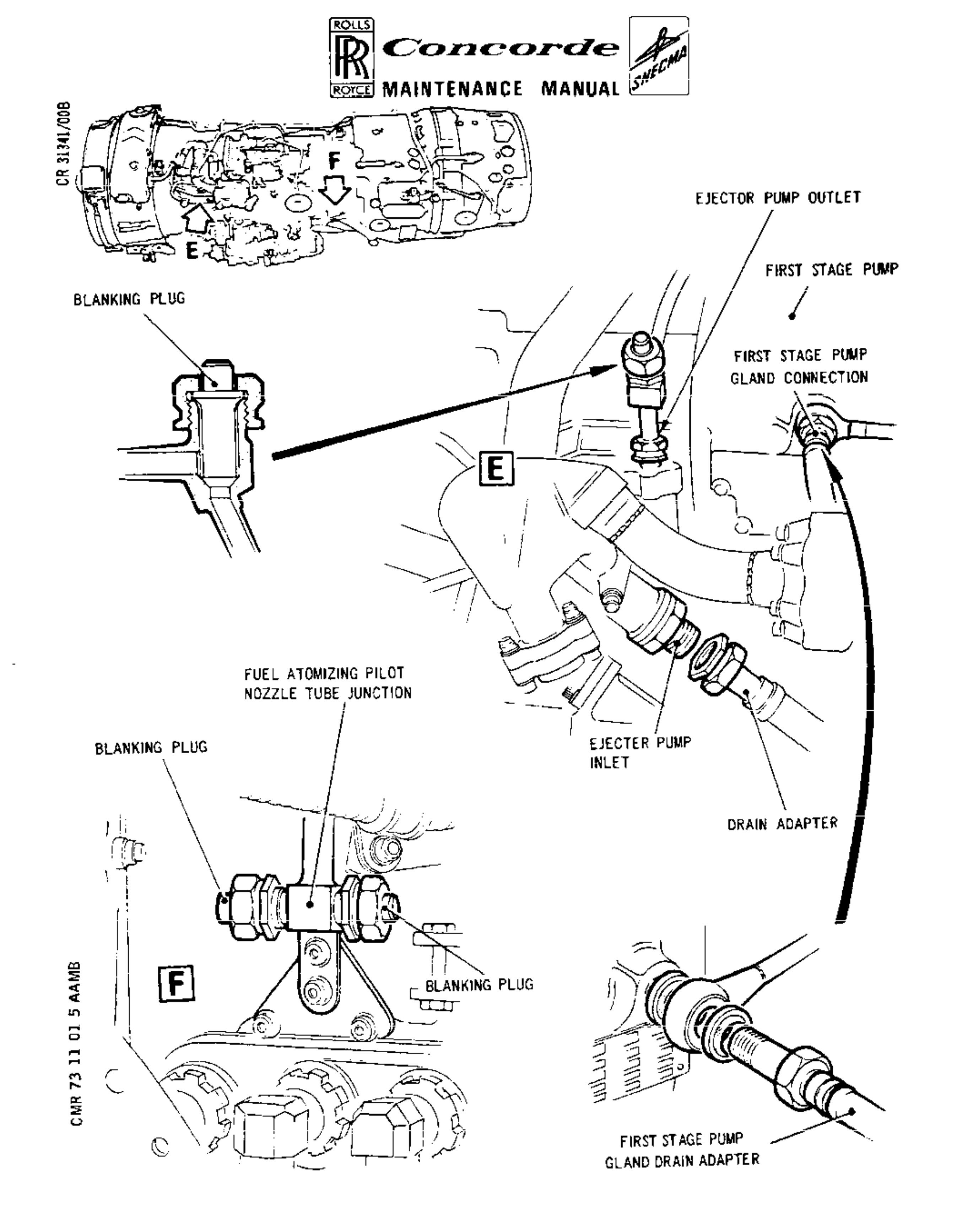
DRAIN ADAPTER ASSEMBLY (INCORPORATING RELIEF VALVE)

B

CMR 73 11 01 5 AAMA

Installation of Test Equipment and Location
(Sheet 1 of 2)
Figure 501

R



Installation of Test Equipment and Location
(Sheet 2 of 2)
Figure 501

R

Remove air bleed tube.

(3) Carry out the low pressure test.

(a) With 30 psig (207 kPa) pressure applied, check leakage rate from the ejector pump inlet. Measure leakage from drain adapter. The maximum acceptable leakage rate is 1 cc/min.

(b) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage and ensure that the following conditions are met before commencing the high pressure test.

R (b1) Gland seal leakage should be minimal. Compare with high pressure test limits as a guide (Ref. para.(4) (d)).

R (b2) No leakage from the primary static seals is acceptable. If a leak shows at the disconnected outlets of the seal failure drains system, find defective seal(s) by a process of elimination. (Ref.para.E).

NOTE: A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

R (b3) There should be no spill from the throttle actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

(4) Continue with a high pressure test.

(a) Operate the test rig and increase the test pressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check the first stage pump and disconnected seal failure drain connections for signs of leaks. No leaks are acceptable. If a leak is disclosed, find defective seal(s) by a process of elimination (Ref.para.E).

NOTE: The seal drains connections at the pump and inlet elbow are interconnected internally to more than one seal.

(d) Maintain the pressure long enough to measure accurately leakage from the installed drain adapters at the first stage pump. Use a graduated measuring jar and stop watch. The acceptable limits are as follows:

(i) First stage pump ... ... 10 cc/min

(ii) Ejector pump inlet ... ... 10 cc/min

(e) If spill from actuator gearbox adapter appears excessive (100 cc/min maximum acceptable limit)
R carry out an accurate leak rate check as speci-
R fied in 73-00-00, Adjustment/Test.

(f) Reduce test pressure to zero and stop pump motor.

(5) On completion of pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hose. Open the bleed valve to expedite draining.

CAUTION: ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED. FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

E. Procedure to Locate and Rectify a Leak.

(1) Gland drain connection leakage.

(a) Excessive gland leakage is directly observed at the component and rectification will be by replacement of component.

(2) Seal failure drains connection leakage.

(a) Establish the location of the defective seal (Ref. Fig. 502).

(b) Renew a defective seal or component and then repeat the pressure test and leak check.

F. Remove Test Equipment and Install/Connect Engine Components.

R (1) Carry out the procedures of 73-00-00, Adjustment/
R Test, paragraph 6.D. as detailed for the removal and

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INLET ELBOW

FUEL TUBE.SPILL RETURN

FIRST STAGE PUMP

LH GEARBOX

TO HEATER AND FILTER

DRAIN VALVE

EJECTOR PUMP

THERMOMETER

SEAL DRAINS

SEAL DRAINS

REHEAT SUPPLY

GLAND DRAIN

CMR 73 11 01 5 BAM0

First Stage Pump Seal Failure Drains
Transfer Passenger and Outlets
Figure 502

installation of the following items of test equipment and engine components respectively.

NOTE: If an engine is to be inhibited, refer to Inhibiting and Storage 70-00-07, and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(a) PE.20757 - blank and PE.27277 - clamp ring. Remove inlet connection blank and clamp ring and reconnect the aircraft/engine main fuel connection.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve). Remove hose and adapter and install drain valve.

(c) PE.29937 - blanking plug. Remove plug and install blanking ferrule at ejector pump.

(d) PE.35666 - drain adapter. Remove adapter and install the blanking plug in the actuator gearbox.

(e) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

(2) PE.20746 - drain adapter. Remove drain adapter at the ejector pump inlet.

(3) PE.29971 - drain adapter. Remove the drain adapter at the first stage pump gland drain connection.

(4) Carry out a final leak check. Comply with the procedure detailed in paragraph 2.C.(2).

(5) PE.20748 - drain adapter. Remove drain adapter from inlet elbow.

(6) Complete the procedure as detailed in 73-11-01, Removal/Installation.

FIRST STAGE FUEL PUMP - INSPECTION/CHECK

1. General

This section covers the inspection of the first stage fuel pump inducer casing for fuel leaks.

2. Inspection of First Stage Fuel Pump Inducer Casing

A. A visual inspection of the pump for evidence of fuel leakage through the inducer casing wall is required at every London Transit Turnround.

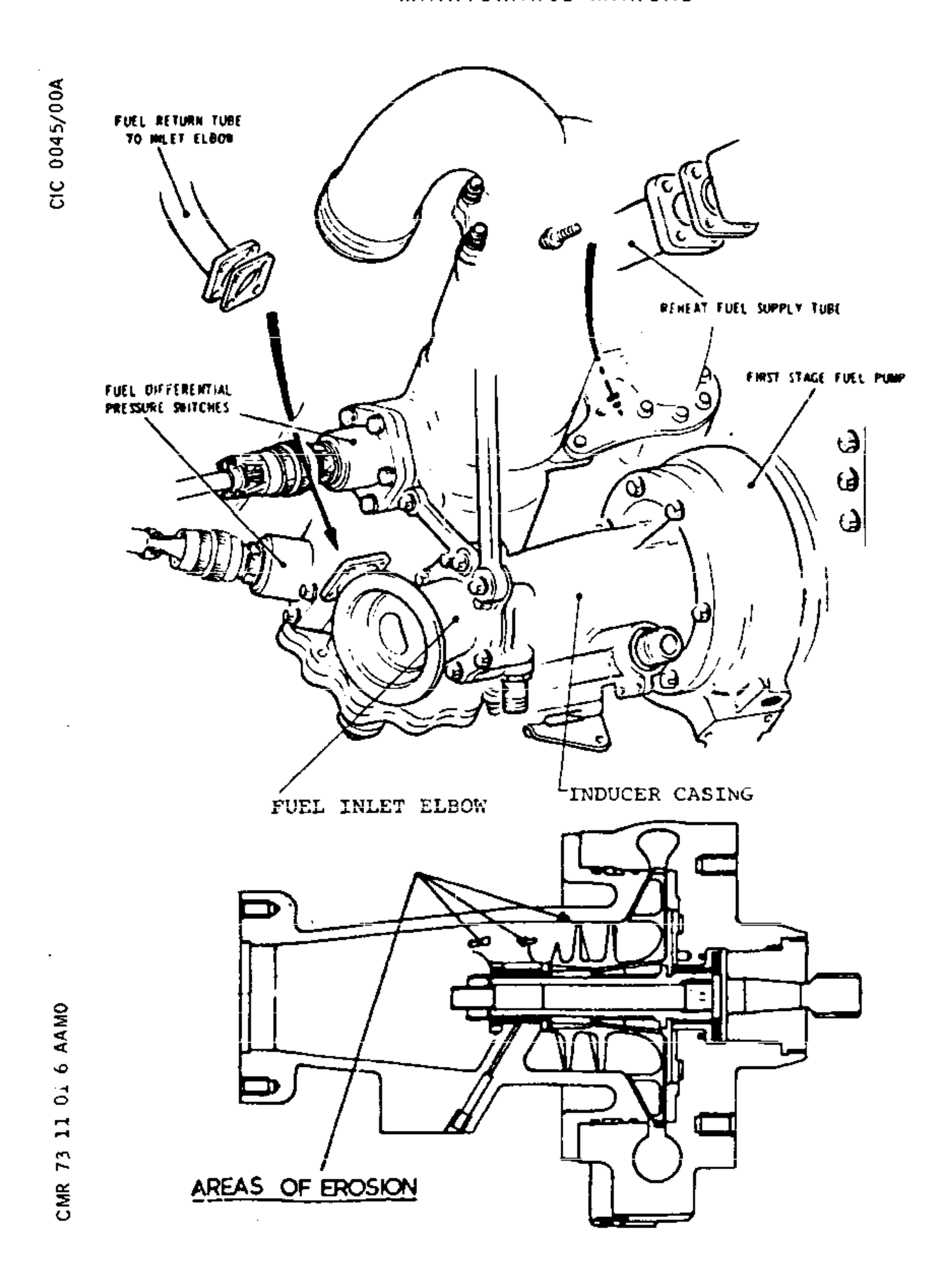
B. Inspection/Check (Ref. Fig. 601)

(1) Open the forward engine bay doors and secure.

(2) Wipe the first stage fuel pump inducer casing clean with a rag.

(3) Switch on the engine feed pumps and inspect the inducer casing for signs of fuel leakage.
NO LEAKS ARE ACCEPTABLE.

NOTE: If fuel is seen to be dripping from the cowling during the walk around inspection, then inspect the fuel pump inducer casing for evidence of leaks as detailed above.



First Stage Fuel Pump
Figure 601

SECOND STAGE FUEL PUMP REMOVAL/INSTALLATION

1. General

The second stage fuel pump is removed and installed with the flow control unit (FCU) as an assembly. The removal of the combined pump and FCU and separation of the pump from the FCU are described in 73-21-01, Removal/Installation.

R

SECOND STAGE PUMP - ADJUSTMENT/TEST

There are two pressure test procedures for the second stage pump (SSP). A pressure test of a combined FCU/SSP is carried out after assembly and prior to installation on an engine and another pressure test is carried out after the FCU/SSP assembly is installed. Both pressure test procedures are detailed in 73-21-01, Adjustment/Test.

ELECTRIC STARTER PUMP - REMOVAL/INSTALLATION

1. General

R R Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

	Air bleed tube	PE.22898
R	Drain tube (Pre S.B.OL.593-73-1 drain valve) ...	PE.34076
R	Drain tube (S.B.OL.593-73-1 drain valve)	PE.26796
	Drain tube for heater and filter drain valve ...	PE.21970
	Circuit breaker safety clip	-

3. Starter Pump (Ref. Fig. 401)

A. Prepare to Remove Pump.

R R (1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.1			
R	LP VALVE SUP 1	15-216	1Q1	C1
R	LP VALVE SUP 2	16-215	1Q2	-
R	START FUEL PUMP SUP	1-213	1Q812	J6
	Engine No.2			
R	LP VALVE SUP 1	15-216	2Q1	F2
R	LP VALVE SUP 2	15-215	2Q2	C19
R	START FUEL PUMP SUP	1-213	2Q812	K6

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.3			
R	LP VALVE SUP 1	15-216	3Q1	F1
R	LP VALVE SUP 2	15-215	3Q2	C20
R	START FUEL PUMP SUP	1-213	3Q812	L6
	Engine No.4			
R	LP VALVE SUP 1	15-216	4Q1	C2
R	LP VALVE SUP 2	16-215	4Q2	-
R	START FUEL PUMP SUP	1-213	4Q812	M6

Circuit Breakers
Table 401

(4) Drain the engine fuel system.

R (a) Open bleed valve to expedite draining.

R (b) Use drain tube PE.34076 (Pre S.B.OL.593-73-1
R drain valve) or PE.26796 (S.B.OL.593-73-1 drain
R valve) at the inlet elbow drain valve, and drain
R tube PE.21970 at the fuel heater and filter drain
R valve. Direct free ends of drain tubes into a
R container and drain the system upstream of the
R FCU.

R (c) When fuel drain ceases, remove the drain tubes
R and close the bleed valve.

R (d) Drain the starter pump concurrent with the removal of the unit.

NOTE: Discard drained fuel or inhibiting fluid.

B. Remove Pump.

R (1) Disconnect electrical lead end plug from pump.

R (2) Detach fuel tubes from starter pump.

(a) Starter pump fuel inlet.

CR 30448/00B

ELECTRICAL CONNECTION

FORWARD

A

B

SUPPLY TO FUEL ATOMIZING PILOT NOZZLES

FUEL INLET TUBE

SEAL FAILURE DRAIN TUBE

FUEL RETURN TO FCU

A

B

CMR 73 11 03 4 AAM0

Starter Pump and Location Detail
Figure 401

R

(b) Starter pump to FCU.

(c) Starter pump supply to fuel atomising pilot nozzles.

(d) Seal failure drains system.

(3) Remove bolt, flatwasher and nut securing pump to HP compressor case front mounting bracket.

(4) Remove bolts and flanged pins securing pump to rear mounting bracket. Remove pump from engine.

R (5) If the pump is not to be re-installed within 48
R hours, it must be inhibited in accordance with
R the instructions detailed in the manufacturers
R Component Overhaul Manual (73-11-03).

C. Install Pump.

(1) Apply lubricant B to pump attachment items.

(2) Assemble pump to engine, secure to front mounting bracket with bolt, flatwasher and nut. Torque-tighten bolt and nut to between 170 and 190 lbf in (19,2 and 21,5 Nm).

(3) Assemble flanged pins, then secure pump to rear mounting bracket with two bolts torque-tightened to between 170 and 190 lbf in (19,2 and 21,5 Nm).

(4) Connect fuel tubes to starter pump.

(a) Second stage pump supply to starter pump.

(i) Apply lubricant A to attachment items.

(ii) Engage union nut and torque-tighten to between 310 and 340 lbf in (35 and 38 Nm). Wire-lock nut.

(b) Starter pump to FCU.

(i) Apply lubricant A to attachment items.

(ii) Engage union nut and torque-tighten to between 280 and 310 lbf in (31,6 and 35 Nm). Wire-lock nut.

(c) Starter pump supply to fuel atomising pilot nozzles.

(i) Apply lubricant A to attachment items.

(ii) Engage union nut and torque-tighten to between 190 and 210 lbf in (21,5 and

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23,7 N.m). Wire-lock nut.

R (5) Connect electrical lead end plug.

R (a) On engines to pre S.B. OL.593-71-15 standard,
R connect tighten and wire-lock lead end plug.

R (b) On engines to S.B.OL.593-71-15 standard,
R connect, tighten and ensure that a white line is
R painted across the connection join to indicate
R final tightened position.

D. Check for Leaks at Connections Disturbed During Procedure.

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure - comply with the procedures given in 73-12-01, Adjustment/Test, paragraph 2.

(b) PTIR pressure - comply with the procedures given in 73-12-01, Adjustment/Test, paragraph 3.

(c) On completion of a static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph E.

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph E.

E. Complete the Installation.

(1) Connect seal drains system.

(a) Apply lubricant A to attachment items.

(b) Connect drains tube to fluid passage bolt at lower drains outlet connection.

(c) Connect interconnecting tube to upper and lower drains outlet connections.

(d) Triple torque-tighten thrust wire type union nut (Ref.70-00-04, Torque Loading Data) to between 90 and 100 lbf in. (10,2 and 11,3 N.m). Wire-lock nut.

(2) Remove safety clips, reset circuit breakers (Ref. Table 401) and open LP fuel isolation valve.

(3) If a leak check is to be made during an engine run carry out a preliminary leak check using the aircraft fuel feed pumps.

(a) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all air from the system.

(b) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(c) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

(d) On completion of check, switch off the aircraft fuel feed pumps.

(4) To complete the installation and/or prepare for ground run, install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(5) If a fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay. doors (Ref.71-00-00, Servicing) that are required for the engine run checks, then comply with the procedures of 73-00-00 and 71-00-00, Adjustment/ Test respectively. On completion of engine run, retrip circuit breakers and attach safety clips.

(6) Close engine doors (Ref.71-00-00, Servicing).

ELECTRIC STARTER PUMP - ADJUSTMENT/TEST

1. General

This chapter includes leak check procedures and functional test procedures.

The leak check procedures detailed in paragraphs 2 and 3 are complementary to the electric starter pump Removal/ Installation procedures. Paragraph 2 details the leak checks using the aircraft fuel feed pumps and paragraph 3 details the leak checks using the pressure test and inhibiting rig (PTIR).

The functional test procedure, given in paragraph 4, is used in conjunction with the trouble shooting procedure for the starter pump and fuel flow control unit (FCU) and is given as an isolated task.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Leak Check with Aircraft Fuel Feed Pumps

A. General

The electric starter pump and associated connections are leak checked, using the appropriate aircraft fuel feed pump and electric starter pump, in conjunction with the procedures detailed in 73-00-00, Adjustment/Test

B. Tools and Equipment.

Pressure test equipment items (contained in adapter set
R PE.29964) are required as follows:

Air bleed tube	PE.22898
Blank	PE.35092
Blank/bleed valve	PE.35065
Blanking unit (2)	AS.15826

C. Prepare to Leak Check Electric Starter Pump and Associated Connections.

(1) Electrically isolate the T1 PROBE HEATER and the RH and LH IGNITION SUP circuit breakers (Ref. Table 501) by tripping the breakers affecting the engine upon which work is to be carried out. Attach

safety clips.

WARNING: WHENEVER ENGINE HP CONTROL CIRCUIT BREAKER IS TO BE TRIPPED OR HP VALVE SWITCH IS SET TO OPEN, FIRST TRIP ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER AND PREVENT UNNECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMPERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No. 1			
T1 PROBE HTR SUP	13-215	1H542	C 9
RH IGNITION SUP	1-213	1J4	N 5
LH IGNITION SUP	2-213	1J3	E12
Engine No.2			
T1 PROBE HTR SUP	14-215	2H542	E 8
RH IGNITION SUP	1-213	2J4	P 5
LH IGNITION SUP	2-213	2J3	B10
Engine No.3			
T1 PROBE HTR SUP	14-216	3H542	C14
RH IGNITION SUP	1-213	3J4	Q 5
LH IGNITION SUP	2-213	3J3	B11
Engine No.4			
T1 PROBE HTR SUP	13-216	4H542	C11
RH IGNITION SUP	1-213	4J4	R 5
LH IGNITION SUP	2-213	4J3	E13

Circuit Breakers
Table 501

(2) Install the following items of test equipment as detailed for each individual item in 73-00-00, Adjustment/Test, para.6.B.

(a) AS.15826 - blanking unit (Ref. Fig. 501) (detail F). Install a blanking unit on each of the fuel atomizing pilot nozzle tube junction connections.

(b) PE.35092 - blank and PE.35065 - blank/bleed

valve. Install items in outlet connections of distribution and dump valve.

(3) Direct free ends of drain tubes into a container.

(4) Ensure that drains tube at electric starter pump seal failure drains connection is detached for leak check (Ref. 73-11-03, Removal/Installation).

D. Leak Check Electric Starter Pump and Associated Connections.

(1) Pressurize and leak check the system.

(a) Remove the safety clips and reset circuit breakers stated in 73-11-03, Removal/ Installation, Table 401. Verify that RH and LH IGNITION SUP circuit breakers given in this topic remain tripped.

(b) Ensure that all fuel connections are secure, open the LP fuel isolation valve and start the appropriate aircraft fuel feed pumps.

(c) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valve, blanking ferrules and the drains outlets of the engine connections under test. No leaks are acceptable.

(2) Pressurize and leak check the electric starter pump supply to fuel atomizing pilot nozzle tube connection.

(a) Select the HP VALVE switch OPEN.

(b) Select the ENGINE DEBOW switch to DEBOW.

(c) Select and hold the RELIGHT/START switch at START.

NOTE: With the LH IGNITION CONT and RH IGNITION CONT circuit breakers tripped, the RELIGHT/START switch will not latch and the electric starter pump operation will cease immediately the switch returns

to OFF.

(d) Check connection for signs of leaks. No leaks are acceptable.

(e) Select ENGINE DEBOW switch to NORMAL.

CAUTION: DO NOT SELECT ENGINE DEBOW SWITCH TO DEBOW WITHIN ONE MINUTE OF RELIGHT/ START SWITCH RETURNING TO OFF.

(f) Release RELIGHT/START switch. If switch does not automatically return to OFF, select OFF.

(g) Select HP VALVE switch to SHUT.

(3) On completion of checks, switch off the aircraft fuel feed pumps.

(4) If a seal failure drains connection leakage should occur, rectify defect and then repeat the leak check.

E. Remove Pressure Test Equipment and Install/Connect Engine Components.

(1) Remove the following items of test equipment and install/connect engine components as detailed for each individual item in 73-00-00, Adjustment/Test, para.6.D.

(a) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle fuel tubes to the tube junction.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

(2) Remove safety clip and reset circuit breakers (Ref. Table 501).

3. Leak Check Using PTIR

A. General.

This paragraph details the procedure for a pressure test and leak check using the PTIR and pressure test equipment. On completion of the PTIR checks a final leak check is required using the aircraft fuel feed pumps to check remade

connections after removal of test equipment.

B. Tools and Equipment.

Pressure test and inhibiting rig (PTIR)... ... PE.17988

Pressure test equipment items (contained in adapter set PE.22964) are required as follows:

Air bleed tube	PE.22898
Adapter (Pre S.B.OL.593-73-1 drain valve)	PE.22972
Adapter (S.B.OL.593-73-1 drain valve) ...	PE.26710
Blank	PE.20757
Blank	PE.35092
Blank/bleed valve	PE.35065
Blanking unit (2)	AS.15826
Blanking plug	PE.29937
Clamp	PE.27277
Drain adapter	PE.20748
Drain adapter	PE.35666
Hose...	PE.22893

C. Test Fluid.

Aviation kerosine	D.Eng.R.D.2494
or	
Inhibiting fluid	DEF.2001A or D.Eng.R.D.2490

D. Install Pressure Test Equipment.

(1) Install the following items of test equipment as detailed for each individual item in 73-00-00, Adjustment/Test para.6.B.

(a) PE.20757 - blank and PE.27277 - clamp (Ref. Fig. 501) (Detail A). Install in fuel inlet elbow.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B. OL.593-73-1 drain valve) or PE.26710 adapter (S.B.OL.593-73-1 drain valve) (Ref. Fig. 501) (Detail A). Assemble hose and adapter to fuel inlet elbow drain valve location.

(c) PE.29937 - banking plug (Ref. Fig. 501) (Detail E). Install in the return fuel tube at outlet to ejector pump/first stage pump.

(d) PE.35666 - drain adapter (Ref. Fig. 501) (Detail B). Install adapter in the throttle valve actuator gearbox spill/drain plug location.

(e) PE.20748 - drain adapter (Ref. Fig. 501) (Detail A). Assemble drain adapter to fuel inlet elbow drain connection.

(f) AS.15826 - blanking unit (Ref. Fig. 501) (Detail F). Install items on fuel atomizing pilot nozzle tube junction connections.

(g) PE.35092 - blank and PE.35065 - blank/bleed valve. Install items in fuel outlet connections of distribution and dump valve.

(2) Direct free ends of drain tubes into a container.

E. Pressure Test Procedure.

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple a self-sealing hose of the test rig to the installed test adapter hose at the inlet elbow.

(c) Verify that the weight of the hose is supported and that all connections are secure before commencing test procedure.

(d) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence the test procedure.

CR 31229/00B

CLAMP
BLANK
FUEL INLET ELBOW
A
B
A
DRAIN VALVE
INLET ELBOW DRAIN ADAPTER
ADAPTER SB.73-1
COVER
HOSE ASSEMBLY
SEALING RING
ADAPTER PRE SB.73-1
THROTTLE VALVE ACTUATOR GEARBOX
DRAIN ADAPTER ASSEMBLY (INCORPORATING RELIEF VALVE)
B

CMR 73 11 03 5 AAMA

Installation of Test Equipment and Location
(Sheet 1 of 2)]
Figure 501

CR 31387/00C

G
F
E

BLANKING PLUG

FIRST STAGE PUMP

EJECTOR PUMP
OUTLET

E

STARTER PUMP
FUEL INLET TUBE

SEAL DRAIN
CONNECTION

G

FUEL ATOMIZING PILOT
NOZZLE TUBE JUNCTION

BLANKING PLU

BLANKING PLUG

F

CMR 73 11 03 5 AAMB

Installation of Test Equipment and Location
(Sheet 2 of 2)
Figure 501

(2) Bleed all air from the system and continue with the low pressure test paragraph (3).

(a) Operate the test rig apply a pressure of 30 psig (207 kPa).

(b) Install air bleed tube PE.22898, open the air bleed valve and allow to bleed until an air free fuel flow is obtained and then close the valve. Remove air bleed tube.

(3) Carry out the low pressure test.

(a) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage and ensure that the following conditions are met before commencing the high pressure test.

(a1) No leakage from the primary static seals is acceptable. If a leak shows from the disconnected outlets of the seal failure drains system, rectify defect (Ref.para. F.).

NOTE: A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

(a2) There should be no spill from the actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

(4) Continue with a high pressure test.

(a) Operate the test rig and increase the test pressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check the disconnected seal failure drains connections for signs of leaks. No leaks are acceptable. If a leak is disclosed, rectify defect (Ref. para. F.).

NOTE: The seal drains connections at the electric starter pump and inlet elbow are interconnected internally to more than one seal.

(d) If spill from actuator gearbox appears excessive (100 cc/min maximum acceptable limit) carry out an accurate leak rate check as specified in 73-00-00 Adjustment/Test.

(e) Reduce test pressure to zero and stop pump motor.

(5) On completion of pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hose. Open the bleed valves to expedite draining.

CAUTION: ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

F. Procedure to Locate and Rectify a Leak.

(1) Inlet elbow seal failure drains connection leakage. Refer to 73-11-01, Adjustment/Test to identify defective seal(s).

(2) Electric starter pump seal failure drains connection leakage. Rectify by renewal of starter pump.

(3) Renew a defective seal or component and then repeat the pressure test and leak check.

G. Remove Test Equipment and Install/Connect Engine Componens.

(1) Remove the following items of test equipment and install engine components as detailed for each individual item in 73-00-00, Adjustment/Test, paragraph 6.D.

NOTE: If an engine is to be inhibited, refer to 70-00-07, Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(a) PE.20757 - blank and PE.27277 - clamp ring Remove blank and clamp ring and reconnect the aircraft/engine main fuel connection.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 -

adapter (S.B.OL.593-73-1 drain valve). Remove hose and adapter and install drain valve.

(c) PE.29937 - blanking. Remove plug and install blanking ferrule at ejector pump.

(d) PE.35666 - drain adapter. Remove adapter and install the blanking plug in the actuator gearbox.

(e) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

(f) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

(2) Carry out a final leak check.

(a) Carry out a final leak check as detailed in paragraph 2.D.(1).

NOTE: The manifold flight standard blanking ferrules cannot be leak checked using aircraft feed pump pressure.

(b) On completion of check, switch off the aircraft feed pumps.

(3) PE.20748 - drain adapter. Remove drain adapter from inlet elbow and connect the seal drains system as detailed in 73-00-00, Adjustment/Test,paragraph 6.D.

(4) Complete the procedure as detailed in 73-11-03, Removal/Installation.

R 4. Functional Test of Electrical Starter Pump

R A. Tools and Equipment

R Test set, fault diagnosis S3S.12408000

R Air bleed tube... ... ... PE.22898

R Drain tube (Pre S.B.OL.593-73-1 drain
R valve) PE.34076

R Drain tube (S.B.OL.593-73-1 drain
R valve) PE.26796

Drain tube (heater and filter drain valve) PE.21970

Circuit breaker safety clip ... ... -

B. Prepare for Starter Pump Test Sequence (Ref. Fig. 502)

(1) Open engine bay front and rear lower doors of an installed engine (Ref.71-00-00, Servicing).

(2) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
RH IGNITION SUP	1-213	1J4	N5
LH IGNITION SUP	2-213	1J3	E12
Engine No.2			
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19
RH IGNITION SUP	1-213	2J4	P5
LH IGNITION SUP	2-213	2J3	B10
Engine No.3			
LP VALVE SUP 1	15-216	3Q1	F1
LP VALVE SUP 2	15-215	3Q2	C20
RH IGNITION SUP	2-213	3J4	Q5
LH IGNITION SUP	2-213	3J3	B11
Engine No.4			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-
RH IGNITION SUP	2-213	4J4	R5
LH IGNITION SUP	2-213	4J3	E13

Circuit Breakers
Table 502 (Concluded)

R (3) Electrically isolate the engine additional services indicated in Table 502 by tripping the circuit breakers affecting the engine upon which work is being carried out. Attach safety clips.

R (4) Drain the inlet section of the system.

R (a) Open bleed valve to expedite draining.

R (b) Use drain tube PE.34076 (Pre S.B.OL.593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE.21970 at the fuel heater and filter drain valve. Direct free ends of drain tubes into a container and drain the system upstream of the FCU.

R (c) When drain ceases, remove the drain tube and close the bleed valve.

R (d) Discard drained fuel or inhibiting fluid.

R C. Check Starter Pump Output Pressure Rise.

R (1) Connect the test set to the test point on the starter pump and prepare for the initial test procedure.

R (a) Remove blanking union nut and nipple.

R (b) Assemble the free flow adapter (S3S.12408006) to the test point connector and tighten securely.

R (c) Connect the test set hose to the adapter and tighten securely.

R (d) Connect the test set earth and direct the test set bleed tube into a container.

R (e) Remove the safety clips and reset the LP VALVE circuit breakers. (Ref. Table 502). Verify that RH and LH IGNITION SUP circuit breakers remain tripped.

R (f) Ensure that all fuel connections are secure, open the LP fuel isolation valve and start the appropriate aircraft fuel feed pumps.

CR 35272/00A

ELECTRIC STARTER PUMP

FUEL INLET TUBE

TEST CONNECTION

CLOSURE FERRULE

UNION NUT

FUEL TO FCU

A

A

RESTRICTED FLOW ADAPTER

FREE FLOW ADAPTER

TEST SET HOSE

CMR 73 11 03 5 BAMO

Functional Test Adapter Installation
Figure 502

R

(g) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve.

(2) Carry out the initial test of the pump pressure rise.

(a) With feed pump pressure applied, open the test set bleed valve. Close valve when fuel flows free of air from the drain tube.

(b) Observe and record the feed pump pressure registered on the test set gauge.

(c) Select the ENGINE DEBOW switch to DEBOW.

<u>CAUTION:</u> KEEP STARTER PUMP RUNNING TO MINIMUM AND DO NOT EXCEED MAXIMUM OF FIVE MINUTES.

(d) Select the RELIGHT/START switch at START.

(e) Observe and record the pressure registered on the test set gauge.

(f) Select ENGINE DEBOW switch to NORMAL.

<u>CAUTION:</u> DO NOT SELECT ENGINE DEBOW SWITCH TO DEBOW WITHIN ONE MINUTE OF RELIGHT/ START SWITCH RETURNING TO OFF.

(g) If RELIGHT/START switch does not automatically return to OFF, select OFF.

(h) Switch off feed pumps and close the LP fuel isolation valve.

(3) Calculate the pressure rise when the starter pump was operated by deducting the first reading from the second.

Minimum acceptable pressure rise... ... 55 p.s.i.g.

(4) If the starter pump pressure rise is satisfactory, continue with the procedure of paragraph D and restore the pump to flight standard.

(5) If the starter pump pressure rise is below the acceptable limit, carry out a test with the FCU isolated.

(a) Drain the starter pump. Open the fuel system

bleed valve and test set bleed valve and allow fuel to drain. Close both bleed valves.

(b) Disconnect the free flow adapter from the starter pump and test set hose and install the restricted adapter (S3S.12408010) in its place. Tighten connections securely.

(c) Open the LP fuel isolation valve, start the feed pumps and carry out a further test of the pump pressure rise as detailed in paragraphs (2) and (3). A satisfactory pressure rise is indicative of an FCU defect and a failure to reach the acceptable limit indicates a defective starter pump (Ref.Trouble Shooting).

(d) Remove the test equipment as detailed in paragraph D and complete the procedure concurrently with the rectification/trouble shooting procedure.

D. Remove Test Equipment and Restore to Flight Standard.

(1) On completion of check, remove test equipment and install starter pump blanking nut and nipple.

(a) Verify that LP fuel isolation valve is closed and trip the LP VALVE circuit breakers (Ref. Table 502).

(b) Drain the starter pump and test set. Open the fuel system bleed valve and test set bleed valve and allow fuel to drain. Close bleed valves and discard drained fuel.

(c) Disconnect test set hose from adapter and remove adapter from starter pump test connection.

(d) Screw blanking nut and nipple on starter pump connection, tighten securely and wire-lock.

(2) When work is completed, pressurize and leak check drain and bleed valves and the starter pump test connection blank concurrently with any other fuel system leak checks. Comply with the following procedure separately if no other checks required.

(a) Remove the safety clip and reset the LP fuel isolation valve circuit breaker (Ref. Table 502).

R (b) Ensure that all fuel connections are secure, open the LP fuel valve and start the appropriate aircraft fuel feed pumps.

R (c) Bleed all air from the system via the air bleed valve. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

R (d) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valves, blanking ferrules and the drains outlets of the aircraft/engine connections under test. No leaks are acceptable.

R (e) On completion of check, switch off the aircraft feed pumps.

R (3) Remove safety clips and reset circuit breakers detailed in Table 502.

R (4) Close engine bay doors (Ref.71-00-00, Servicing).

END OF THIS SECTION

NEXT

FUEL RECIRCULATION VALVE - REMOVAL/INSTALLATION

R 1. General

R Details of approved servicing and storage materials quoted in
R this chapter are given in 70-00-01.

R 2. Tools and Equipment

Air bleed tube PE.22898

R Drain tube (Pre S.B.OL.593-73-1 drain valve) ... PE.34076

R Drain tube (S.B.OL.593-73-1 drain valve) PE.26796

Drain tube for heater and filter drain valve ... PE.21970

R 3. Fuel Recirculation Valve - Removal/Installation
(Ref. Fig. 401)

A. Prepare to Remove.

R (1) Close the LP fuel isolation valve and ensure that
R the valve indicator shows shut.

(2) Open engine bay front doors on engines No.1 and No.3 and engine bay front lower door on engines No.2 and No.4.

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.1			
R	LP VALVE SUP 1	15-216	1Q1	C1
R	LP VALVE SUP 2	16-215	1Q2	-
R	FUEL RECIRC VALVE CONT	3-213	1Q791	G1
	Engine No.2			
R	LP VALVE SUP 1	15-216	2Q1	F2
R	LP VALVE SUP 2	15-215	2Q2	C19
R	FUEL RECIRC VALVE CONT	1-213	2Q791	E5

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.3			
R LP VALVE SUP 1	15-216	3Q1	F1
R LP VALVE SUP 2	15-215	3Q2	C20
R FUEL RECIRC VALVE CONT	1-213	3Q791	E6
Engine No.4			
R LP VALVE SUP 1	15-216	4Q1	C2
R LP VALVE SUP 2	16-215	4Q2	-
R FUEL RECIRC VALVE CONT	3-213	4Q791	G2

Circuit Breakers
Table 401

(3) Drain the engine fuel system.

R (a) Open bleed valve to expedite draining.

R (b) Use drain tube PE.34076 (Pre S.B.OL.593-73-1
R drain valve) or PE.26796 (S.B.OL.593-73-1 drain
R valve) at the inlet elbow drain valve and drain
R tube PE.21970 at the fuel heater and filter drain
R valve. Direct free ends of drain tubes into a
R container and drain the system upstream of the
R FCU.

R (c) When fuel drain ceases, remove the drain tubes
R and close the bleed valve.

R NOTE: Discard drained fuel or inhibiting fluid.

B. Remove Valve.

(1) Disconnect aircraft fuel return tube.

(a) Position container to collect fuel spillage.

(b) Remove clamp ring securing aircraft tube to valve outlet.

R (c) On engines No.2 and No.4 detach fuel tube from
R pillar bolt at valve lower rear mounting loc-

CR 31038/00A

LOWER DRAINS CONNECTION

A

AIRCRAFT FUEL RETURN TUBE

EJECTOR PUMP OUTLET TUBE

UPPER DRAINS CONNECTION

FRONT ATTACHMENT BOLTS

PILLAR BOLT

A

FUEL INLET TUBE

CMR 73 12 01 4 AAMO

Fuel Recirculation Valve
Figure 401

ation.

(2) Disconnect seal failure drain system from valve.

(a) Detach drains tube from fluid passage pillar bolt at lower drains outlet connection.

(b) Detach interconnecting drains tube from upper and lower drains outlet connection. Remove tube and retain for installation.

(3) Remove bolts securing fuel inlet tube flange to valve and extract seal plate.

(4) Unscrew union nut and disconnect fuel tube, first stage pump (ejector pump outlet) to recirculation valve, at valve.

(5) Disconnect electrical lead from valve.

(6) Remove bolts and washers securing valve to front and rear mounting brackets.

(7) Manipulate valve downwards to disengage from aircraft fuel return tube, then remove from engine.

R (8) If the valve is not to be re-installed within 48
R hours, it must be inhibited in accordance with the
R instructions detailed in the manufacturers Component
R Overhaul Manual (73-10-05).

C. Install Valve.

(1) Position valve on engine.

(2) Secure valve to brackets.

(a) Apply lubricant B to attachment bolts.

(b) Attach valve to front and rear mounting brackets at the upper locations with two bolts lightly tightened.

(c) Assemble flat washers to bolt and pillar bolt and secure valve at the lower mounting locations. Ensure that the pillar bolt is installed at the lower rear location.

(d) Torque-tighten four attachment bolts to between 85 and 95 lbf in (9,6 and 10,7 Nm) and wire-lock them together in pairs.

(3) Apply lubricant A, connect fuel tube, valve to first stage pump (ejector pump outlet), to valve and torque tighten union nut to between 190 and 210 lbf in (21,5 and 23,5 Nm). Wire-lock nut.

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(4) Assemble seal plate at inlet fuel tube attachment face and secure tube flange to valve with four bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m) with lubricant B applied.

R (5) Secure aircraft fuel return tube to recirculation valve as detailed in 71-00-02, Power Plant Build-up.

R (a) Secure tube to outlet connection with clamp ring.

R (b) On engines No.2 and No.4 secure tube to pillar bolt at lower rear mounting location.

R D. Check for Leaks at Connections Disturbed During Procedure.

R (1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

R (a) Feed pump pressure - comply with the procedures given in 73-12-01, Adjustment/Test, paragraph 2.

R (b) PTIR pressure - comply with the procedures given in 73-12-01, Adjustment/Test, paragraph 3.

R (c) On completion of a static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph E.

R (2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph E.

R E. Complete the Installation.

R (1) Connect, tighten and wire-lock electrical connection lead end plug to valve.

R (2) Connect seal failure drains system tubes to valve.

R (a) Apply lubricant A to attachment items.

R (b) Connect drains tube to fluid passage bolt at lower drains outlet connection.

R (c) Connect interconnecting tube to upper and lower drains outlet connections.

R (d) Triple torque-tighten three thrust wire type

R union nuts (Ref.70-00-04, Torque Loading Data) to between 90 and 100 lbf in. (10,2 and 11,3 N.m) and wire-lock them.

R (3) If not already done during a fuel leak check procedure, remove safety clips, reset circuit breakers (Ref. Table 401) and open LP fuel isolation valve.

R (4) If a leak check is to be made during an engine run carry out a preliminary leak check using the aircraft fuel feed pumps.

R (a) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all air from the system.

R (b) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

R (c) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

R (d) On completion of check, switch off the aircraft fuel feed pumps.

R (5) To complete the installation and/or prepare for ground run, install the bleed and drain valve caps.

R (a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

R (b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

R (6) If a fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing) that are required for the engine run checks, then comply with the procedures of 73-00-00 and 71-00-00, Adjustment/Test respectively. On completion of engine run, retrip circuit breakers and attach safety clips.

R (7) Close engine bay doors (Ref.71-00-00, Servicing).

FUEL RECIRCULATION VALVE - ADJUSTMENT/TEST

R 1. General

R This chapter is complementary to the Removal/Installation of
R the fuel recirculation valve and details the procedures for
R leak checks by application of a static pressure. Paragraph 2
R details the leak checks using the aircraft fuel feed pumps and
R paragraph 3 details the leak checks using the pressure test
R and inhibiting rig (PTIR).

R The procedure for a leakage check of the recirculation valve
R outlet to aircraft connection is given in 28-21-00, Adjustment/
R Test and is carried out in conjunction with the static leak
R check procedures.

R Details of approved servicing and storage materials quoted in
R this chapter are given in 70-00-01.

R 2. Leak Check with Aircraft Fuel Feed Pumps

R A. General

R The fuel recirculation valve and associated connections
R are leak checked, using the appropriate aircraft fuel feed
R pumps, in conjunction with the procedures detailed in
R 28-21-00, Adjustment/Test.

R B. Tools and Equipment

R Air bleed tube PE.22898

R C. Leak Check Fuel Recirculation Valve and Associated
R Connections.

R (1) Ensure that drains tubes at fuel recirculation valve
R seal failure drains connections are detached for
R leak checks (Ref.73-12-01, Removal/Installation).

R (2) Pressure test and leak check the aircraft fuel return
R tube connection at the recirculation valve as
R detailed in 28-21-00, Adjustment/Test, concurrent
R with the following test procedures.

R (3) Apply static pressure and check for leaks.

R (a) Remove the safety clips and reset circuit
R breakers (Ref.73-12-01, Removal/Installation,
R Table 401).

R (b) Ensure that all fuel connections are secure, open the LP fuel isolation valve and start the appropriate aircraft fuel feed pumps.

R (c) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

R (d) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valves, blanking ferrules and the drains outlets of the engine connections under test. No leaks are acceptable.

R (e) On completion of check, switch off the aircraft feed pumps.

R (4) If a seal failure drains connection leakage should occur.

R (a) Establish the location of the defective seal by reference to illustration (Ref. Fig. 502).

R (b) Renew a defective seal or component and then repeat the leak check.

R 3. <u>Leak Check Using PTIR</u>

R A. General

R This paragraph details the procedure for a pressure test and leak check using the PTIR and pressure test equipment. On completion of the PTIR checks a final leak check is required using the aircraft fuel feed pumps to check remade connections after removal of test equipment.

R The leak check is carried out in conjunction with the procedures detailed in 73-00-00, Adjustment/Test, and 28-21-00, Adjustment/Test.

B. Tools and Equipment.

Pressure test and inhibiting rig (PTIR)...PE.17988

Pressure test equipment (contained in adapter set PE.22964) are required as follows:

R Air bleed tube PE.22898

CR 31229/00B

CLAMP

BLANK

FUEL INLET ELBOW

A

B

INLET ELBOW DRAIN ADAPTER

DRAIN VALVE

ADAPTER SB.73-1

COVER

HOSE ASSEMBLY

SEALING RING

ADAPTER PRE SB.73-1

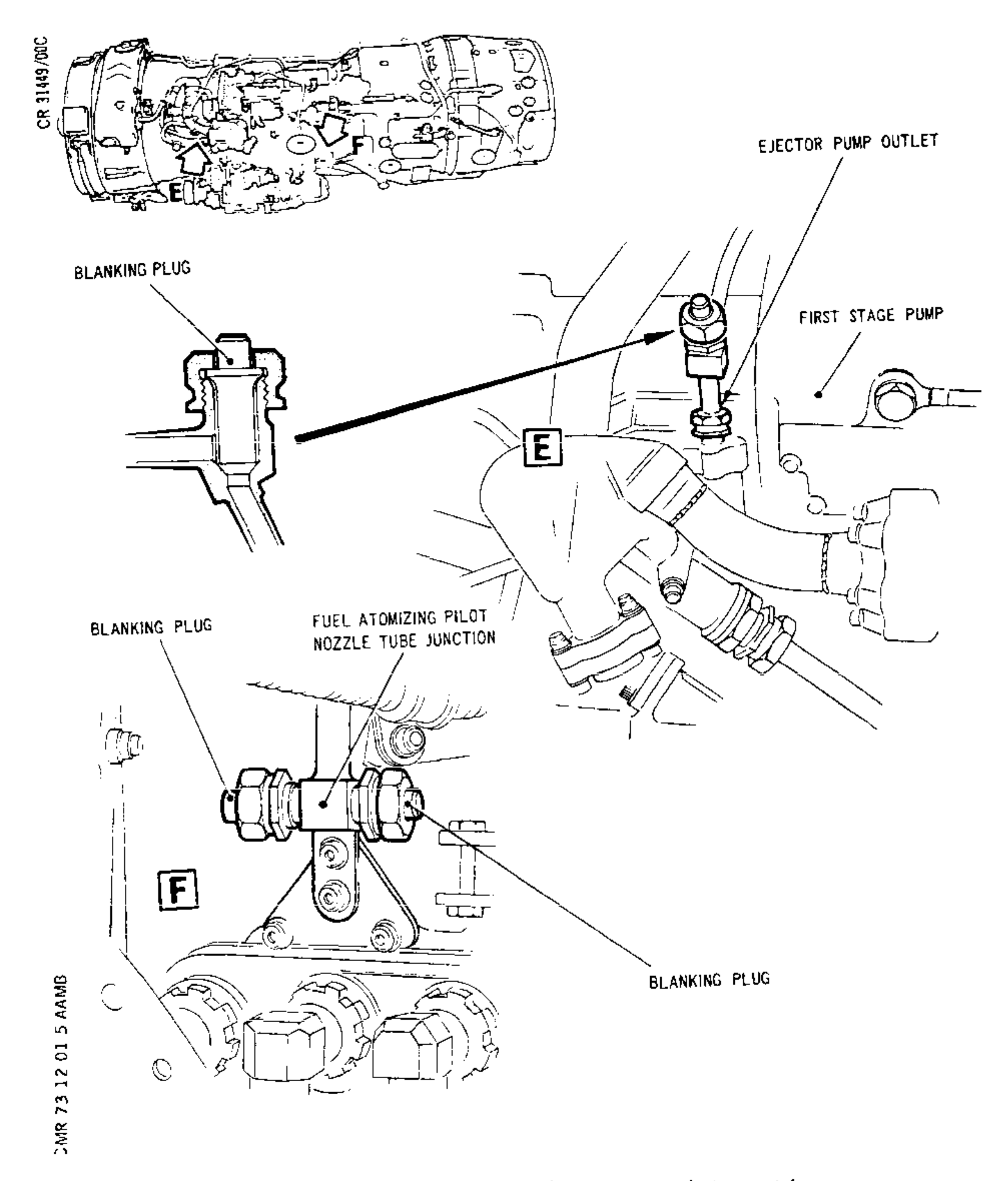
THROTTLE VALVE ACTUATOR GEARBOX

DRAIN ADAPTER ASSEMBLY (INCORPORATING RELIEF VALVE)

CMR 73 12 01 5 AAMA

Installation of Test Equipment and Location
(Sheet 1 of 2)
Figure 501

R



Installation of Test Equipment and Location
(Sheet 2 of 2)
Figure 501

R

R Adapter (Pre S.B.OL.593-73-1
R drain valve) PE.22972

R Adapter (S.B.OL.593-73-1 drain valve)PE.26710

Blank PE.20757

Blanking unit (2) AS.15826

Blanking plug PE.29937

Clamp PE.27277

Drain adapter PE.20748

R Drain adapter PE.35666

Hose PE.22893

R C. Test Fluid.

R Aviation kerosine D.Eng.R.D.2494
R or
R Inhibiting fluid DEF.2001A
R or
R D.Eng.R.D.2490

R D. Install Pressure Test Equipment.

R (1) Install the following items of test equipment as
R detailed for each individual item in 73-00-00,
R Adjustment/Test para 6.B.

R (a) PE.20757 - blank and PE.27277 - clamp
R (Ref. Fig. 501) (detail A). Install in the fuel
inlet elbow.

R (b) PE.22893 - hose and PE.22972 - adapter (Pre
R S.B.OL.593-73-1 drain valve) or PE.26710 -
R adapter (S.B.OL.593-73-1 drain valve)
R (Ref. Fig. 501) (detail A). Assemble hose and
R adapter to fuel inlet elbow drain valve location.

R (c) PE.29937 - blanking plug (Ref. Fig. 501)
R (detail E). Install in the return fuel tube at
R outlet to ejector pump/first stage pump.

R (d) PE.35666 drain adapter (Ref. Fig. 501)
R (detail B). Install in the throttle valve
R actuator gearbox spill/drain plug location.

R (e) PE.20748 - drain adapter (Ref. Fig. 501)
R (detail A). Assemble drain adapter to fuel
R inlet elbow drain connection.

R (f) AS.15826 - blanking unit (Ref. Fig. 501)
R (detail F). Install items on fuel atomizing
R pilot nozzle tube junction connections.

R (g) Direct free ends of drain tubes into a container.

R E. Pressure Test Procedure.

R (1) Pressure test and leak check the aircraft fuel return
R tube connection at the recirculation valve as
R detailed in 28-21-00, Adjustment/Test, concurrent
R with the following test procedure.

(2) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple a self-sealing hose of the test rig to the installed test adapter hose at the inlet elbow.

(c) Verify that the weight of the hose is supported and that all connections are secure before commencing test procedure.

(d) Apply pressures slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence the test procedure.

(3) Bleed all air from the system and continue with the low pressure test, paragraph (4).

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

R (b) Install air bleed tube PE.22898, open the air
R bleed valve and allow to bleed until an air free
R fuel flow is obtained and then close the valve.
R Remove air bleed tube.

(4) Carry out the low pressure test.

(a) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage and ensure that the following conditions are met before commencing the high pressure test.

(i) No leakage from the primary static seals is acceptable. If a leak shows from the disconnected outlets of the seal failure drains system, find defective seal(s) by a process of elimination (Ref. para. F.).

<u>NOTE</u>: A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

(ii) There should be no spill from the throttle actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

(5) Continue with a high pressure test.

(a) Operate the test rig and increase the test pressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check the disconnected seal failure drains connections for signs of leaks. No leaks are acceptable. If a leak is disclosed, find defective seal(s) by a process of elimination (Ref. para.F.).

<u>NOTE</u>: The seal drains connections at the fuel recirculation valve and fuel inlet elbow are interconnected internally to more than one seal.

(d) If spill from actuator gearbox adapter appears excessive (100 cc/min maximum acceptable limit) carry out an accurate leak rate as specified in 73-00-00, Adjustment/Test.

(e) Reduce test pressure to zero and stop pump

CR 31337/00A

ADAPTER

A/C CONNECTION

INLET FROM EJECTOR PUMP

SEAL DRAINS

INLET FROM SECOND STAGE PUMP

BODY

SOLENOID JACKET

SEAL DRAINS

CMR 73 12 01 5 BAM0

Fuel Recirculation Valve Seal Failure Drains
Transfer Passages and Outlets
Figure 502

motor.

(6) On completion of, drain the fuel system using the test rig facilities and then uncouple the delivery hose. Open the bleed valve to expedite draining.

CAUTION: ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED. FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

F. Procedure to Locate and Rectify a Leak.

(1) Inlet elbow seal failure drains connection leakage. Refer to 73-11-01, Adjustment/Test to identify defective seal(s).

(2) Recirculation valve seal failure drains connection leakage. Establish the location of the defective seal by reference to illustration (Ref. Fig. 502).

(3) Renew a defective seal or component and then repeat the pressure test and leak check.

G. Remove Test Equipment and Install/Connect Engine Components.

(1) Remove the following items of test equipment and install engine components as detailed for each individual item in 73-00-00, Adjustment/Test, paragraph 6.D.

NOTE: If an engine is to be inhibited, refer to 70-00-07, Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(a) PE.20757 - blank and PE.27277 - clamp ring. Remove blank and clamp ring and reconnect the aircraft/engine main fuel connection.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve). Remove hose and adapter and install drain valve.

(c) PE.29937 - blanking plug. Remove plug and install blanking ferrule at ejector pump.

(d) PE.35666 - drain adapter. Remove adapter and install the blanking plug in the actuator gearbox.

R (e) AS.15826 - blanking units. Remove blanks and
R connect fuel atomizing pilot nozzle tubes to
R the tube junction.

R (2) Carry out a final leak check. Comply with the
R procedure detailed in paragraph 2.C.(3).

R (3) PE.20748 - drain adapter. Remove drain adapter from
R inlet elbow and connect the seal failure drains
R system as detailed in 73-00-00, Adjustment/Test,
R paragraph 6.D.

R (4) Complete the procedure as detailed in 73-12-01,
R Removal/Installation.

FUEL DISTRIBUTION AND DUMP VALVE - REMOVAL/INSTALLATION

1. General

The fuel distribution and dump valve is located on the engine left-hand side and is removed as a unit after removal of the fuel flowmeter.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Reset tool, for LP shaft signal system PE.27252

R Rigging pin, for LP shaft signal system ... S3S 15669000

Circuit breaker safety clip ... ... -

3. Prepare to Remove Fuel Distribution and Dump Valve

A. Open Engine Bay Doors, Isolate Fuel Supply and Electrical Power.

(1) Close the LP isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay doors on engines 1 and 3 and engine bay lower doors on engines 2 and 4 (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No. 1			
FUEL FLOW IND SUP	14-215	E471	C15
TCA AND FUEL TEMP IND	4-213	1E52	E20
HP VALVE POSN IND	15-216	E214	A10
HP VALVE POSN AMP SUP	13-216	E211	A6
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.2			
FUEL FLOW IND SUP	13-215	E472	D16
TCA AND FUEL TEMP IND	4-213	2E52	B20
HP VALVE POSN IND	15-215	E213	B17
HP VALVE POSN AMP SUP	13-215	E212	G13
LP VALVE SUP 1	15-216	2Q1	F 2
LP VALVE SUP 2	15-215	2Q2	C19
Engine No.3			
FUEL FLOW IND SUP	13-216	E564	D 4
TCA AND FUEL TEMP IND	4-213	3E52	B21
HP VALVE POSN IND	15-215	E213	B17
HP VALVE POSN AMP SUP	13-215	E212	G13
LP VALVE SUP 1	15-216	3Q1	F 1
LP VALVE SUP 2	15-215	3Q2	C20
Engine No.4			
FUEL FLOW IND SUP	14-216	E565	B 3
TCA AND FUEL TEMP IND	4-213	4E52	E21
HP VALVE POSN IND	15-216	E214	A10
HP VALVE POSN AMP SUP	13-216	E211	A 6
LP VALVE SUP 1	15-216	4Q1	C 2
LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 401

B. Remove Starter Cross-feed Duct or Detach Electrical Harness Support Tray.

(1) On Engines No.1 and No.3 detach electrical harness support tray and tie-rod at the engine mounted
R brackets (Ref.71-00-12, Removal/Installation).

(2) On Engines No.2 and No.4 remove section of cross-
R feed duct, intercommunication valve to housing (Ref.
R 71-00-12, Removal/Installation).

C. Remove Engine Fuel Flowmeter

(1) Remove engine fuel flowmeter as detailed in 73-33-01, Removal/Installation.

(2) Drain the distribution and dump valve concurrent with the removal of the engine fuel flowmeter.

<u>NOTE</u>: Discard drained fuel or inhibiting fluid.

D. Disconnect LP Shaft Signal System from Distribution and Dump Valve (Ref. Fig. 401).

(1) Trip the quick shut-down valve plunger mechanism.

(a) Trip the mechanism and check operation as detailed in 76-21-00, Inspection/Check, paragraph 3.B. If the distribution and dump valve is to be renewed it is not necessary to establish the force required to trip the reset plunger. Do not reconnect or re-arm the mechanism at this stage.

(b) If the acceptable limits of operation for the plunger mechanism are not met, rectify defect by renewal of the distribution and dump valve concurrent with the following procedures.

(2) Disconnect front cable from valve plunger mechanism.

(a) Remove nuts and bolts securing flanged front adapter to shroud.

(b) Slacken the shroud locking bolts, turn shroud until withdrawal slots are aligned and withdraw reset plunger.

(c) Remove retaining ring rearward from locating groove and leave in position on flanged rear adapter.

(d) Slacken clamp retaining bolt and slide shield rearward to abut cylinder and piston assembly.

(e) Disengage cable and turn shield to clear attachment flange.

E. Disconnect Electrical Leads.

(1) Disconnect electrical leads from the distribution and

CR 31039/00C

RIGGING PIN

SLEEVE

WITH FULL PENETRATION SLEEVE IS IN FULL CONTACT WITH NO FREE MOVEMENT

PIN FULLY IN

SECONDARY PLUNGER

PULL OFF PLUNGER

PLUNGER SLEEVE

SHROUD

RIGGING PIN HOLE

RESET PLUNGER

A

CLAMP

RETAINING CLIP

DISTRIBUTION AND DUMP VALVE

SHROUD

FLANGED FRONT ADAPTER

CABLE

SHIELD

SECONDARY PLUNGER

RED INDICATOR MARK

RESET PLUNGER

CMR 73 12 02 4 AAM0

LP Shaft Signal System Installation Details
Figure 401

R

dump valve.

(a) Fuel atomizing nozzles inlet thermometer.

(b) HP shut-off valve position transmitter.

F. Remove Fuel Drain Tube - Distribution and Dump Valve Dump Outlet to Drains Tank (Ref. Fig. 402).

(1) Detach tube clamp assembly.

(2) Remove three bolts securing tube flange and bracket to distribution and dump valve.

(3) Support tube and unscrew union nut from drains tank. Disengage tube spigot from dump outlet and move tube clear of work area.

G. Detach Seal Failure Drains System from Distribution and Dump Valve (Ref. Fig. 403).

(1) Detach drains tube from fluid passage bolt.

(2) Remove fluid passage bolt and two sealing washers securing connector to distribution and dump valve.

H. Detach Fuel Tubes (Ref. Fig. 404).

(1) Remove flange bolts and detach fuel tubes at the distribution and dump valve rear face connections.

(a) Fuel supply tubes to manifold connections.

(b) Servo spill tubes connections.

(c) Withdraw seal plates.

(2) Remove flange bolts and detach fuel tubes from the distribution and dump valve at the dump valve casing connections.

(a) Electric starter pump supply to fuel atomizing pilot nozzles tube at dump valve casing inlet connection.

(b) Electric starter pump supply to fuel atomizing pilot nozzles tube at dump valve casing outlet connection - detach air bleed tube support bracket when flange bolts are removed.

(c) Dump valve servo tube connection.

CR 30467/00A

DUMP OUTLET

DISTRIBUTION AND DUMP VALVE TO DRAINS TANK TUBE

A

B

DRAINS TANK

DRAINS TUBE CLAMP ASSEMBLY

A

B

CMR 73 12 02 4 BAMO

Fuel Drain Tube - Distribution and Dump Valve,
Dump Outlet to Tank
Figure 402

R

DISTRIBUTION AND DUMP VALVE
DUMP OUTLET

SEAL WASHERS

FLUID PASSAGE
BOLT

CR 31041/00A

CONNECTOR

DRAINS TUBES

CMR 73 12 02 4 CAMO

Seal Failure Drains System Connection at
Distribution and Dump Valve
Figure 403

R

CR 31036/00B

STARTER PUMP SUPPLY TO FUEL ATOMIZING PILOT NOZZLES

SERVO SPILL TUBE

OUTLET CONNECTION

INLET CONNECTION

DUMP VALVE SERVO TUBE

AIR BLEED TUBE

SERVO AND SERVO SPILL TUBES

STARTER PUMP SUPPLY TO FUEL ATOMIZING PILOT NOZZLES

MANIFOLD FUEL SUPPLY TUBES

CMR 73 12 02 4 DAMO

DUMP VALVE SERVO TUBE

Fuel Distribution and Dump Valve Fuel Tube Connections
Figure 404

R

(d) withdraw seal plates.

J. Remove Air Bleed Tube Section (Engines Installed in No.1 or 3 Bays Only).

(1) Unscrew the union nut at the tube joint of the air bleed tube and remove tube from engine.

4. <u>Remove Distribution and Dump Valve.</u>

A. Detach Distribution and Dump Valve from Mountings (Ref. Fig.405).

(1) Remove nuts, flat washers and bolts securing bracket at front of unit to bracket on reheat controller and bolts securing the bracket to the distribution and dump valve. Remove bracket from engine.

(2) Remove bolts securing distribution and dump valve to reheat controller adjacent to reheat shut-off valve/reheat purge valve flange rear attachment, and throttle valve motor connection position.

(3) Support distribution and dump valve and remove flanged pins.

(4) Remove distribution and dump valve from engine.

R (5) If the valve is not to be re-installed within 48
R hours, it must be inhibited in accordance with the
R instructions detailed in the manufacturers Component
R Overhaul Manual (73-12-02).

5. <u>Prepare to Install Distribution and Dump Valve</u>

A. Prepare a New Unit for Installation.

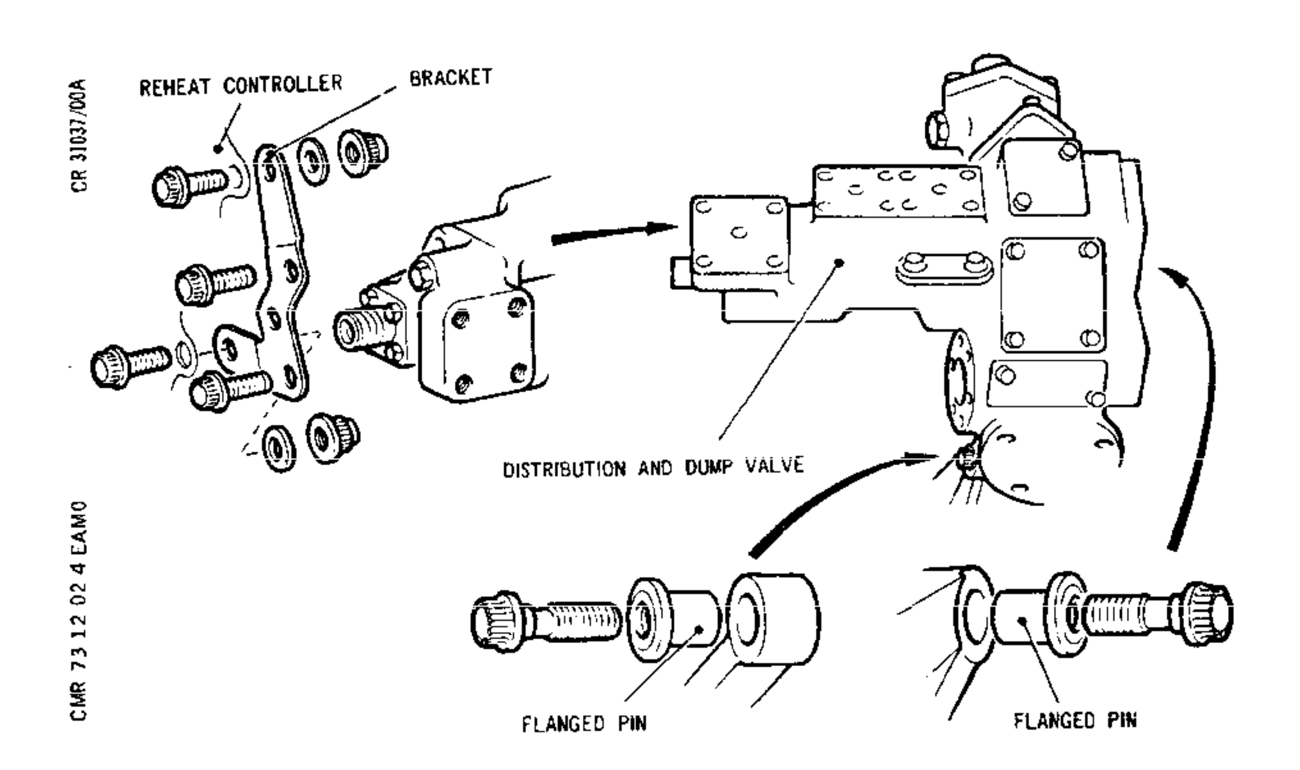
(1) Drain inhibiting fluid from unit.

(2) Transfer fuel atomizing nozzles inlet thermometer from removed unit to new unit.

(a) Remove bolts securing thermometer to unit.

(b) Remove thermometer and seal plate.

(c) Apply lubricant A to attachment bolts.



\- Distribution and Dump Valve Attachment/
Detachment Details
Figure 405

(d) Assemble serviceable seal plate (Ref.70-00-03, Sealing Devices) and thermometer to new unit and secure flange with four bolts, locate bolt for wire-locking at lower inner location. Torque-tighten bolts to between 67 and 73 lbf in (7,6 and 8,2 Nm).

6. Install Distribution and Dump Valve

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A. Assemble Unit to Mountings (Ref. Fig. 405).

(1) Position distribution and dump valve on reheat fuel controller and secure with a flanged pin and bolt near the following locations. Apply lubricant B and torque-tighten bolts to between 160 and 180 lbf in. (18,1 and 20,3 N.m).

(a) Reheat shut-off valve/reheat purge valve flange.

(b) Reheat throttle valve motor connection position.

(2) Install bracket at front mounting location.

(a) Apply lubricant B to attachment items.

(b) Position bracket between reheat fuel controller bracket and the distribution and dump valve.

(c) Secure bracket to distribution and dump valve with two bolts and to bracket on reheat controller with two bolts, flat washers and nuts. Torque-tighten bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

B. Attach Fuel Tubes to Distribution and Dump Valve (Ref. Fig. 404).

(1) Two fuel supply tubes to manifold connections.

(a) Apply lubricant B to attachment bolts.

(b) Insert a serviceable seal plate and secure each tube flange to distribution and dump valve with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(2) Two servo spill tubes.

(a) Apply lubricant B to attachment bolts.

(b) Insert a serviceable seal plate and secure each tube flange to distribution and dump valve with three bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

<u>NOTE</u>: The three short bolts are located at the lower tube flange and the long bolt at the top location of the upper tube flange.

(3) Electric starter pump supply to fuel atomizing pilot nozzles (inlet connection).

(a) Apply lubricant B to attachment bolts.

(b) Insert new seal plate and secure tube flange, together with air bleed tube support bracket, to distribution and dump valve with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(4) On engines installed in No.1 or 3 bays, connect the air bleed tube at the tube joint.

(a) Apply lubricant A at union nut connection.

(b) Screw on union nut and torque-tighten it to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(c) Wire-lock union nut.

(5) Starter pump supply to fuel atomizing pilot nozzles (outlet connections).

(a) Apply lubricant B to attachment bolts.

(b) Insert serviceable seal plate and secure tube flange together with air bleed tube support bracket, to distribution and dump valve with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(6) Dump valve servo tube.

(a) Apply lubricant B to attachment bolts.

(b) Insert serviceable seal plate and secure tube flange to distribution and dump valve with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

C. Connect Electrical Leads.

(1) Connect, tighten and wire-lock electrical connection lead end plugs to the shut-off valve position transmitter and the fuel atomizing nozzles inlet thermometer locations.

D. Install Engine Fuel Flowmeter (Ref.73-33-01, Removal/Installation).

E. Connect Front Cable to Valve Plunge Mechanism (Ref. Fig. 401).

(1) Ensure that the mechanism is tripped. On a new unit, remove transportation blank and trip mechanism. Prevent plungers from moving out of plunger sleeve and remove reset plunger.

(2) With slots of shroud, flanged front adapter and shield in alignment, engage cable end with secondary plunger recess.

(3) Insert reset plunger to retain cable and turn shroud to retain plunger.

(4) Secure shroud.

(a) Remove each bolt securing shroud to distribution and dump valve separately, apply lubricant A and replace bolt.

(b) Apply lubricant A and assemble the two bolts and nuts to the shield front flanged adapter to shroud flanges.

(c) Check that locking torque of bolts retaining shield to shroud and shroud to distribution and dump valve is not less than 2 lbf in. (0,2 N.m).

(d) Torque-tighten shield to shroud retaining nuts and bolts to 40 lbf in. (4,5 N.m).

(e) Check that reset plunger is free to move sideways in and out of the slot by approximately 0.010 to 0.020 in. (0,25 to 0,50 mm) and progressively tighten shroud to distribution and dump valve bolts to 40 lbf in. (4,5 N.m) while ensuring that the reset plunger remains free. If free movement is lost, turn shroud the minimal amount away from the end of flange slot to a position that will restore the required movement when the bolts are tight.

(5) Assemble retaining ring to shield rear adapter groove and slide shield rearward to abut it. Position clamp and torque-tighten clamping bolt to between 67 and 73 lbf in. (7,57 and 8,25 N.m).

F. Check Operation of LP Shaft Signal System and Complete the System Installation.

R (1) If the distribution and dump valve has been renewed, carry out the re-arming and check procedure detailed for the operating mechanism in 76-21-00, Inspection/ Check, paragraph E. and B. respectively.

R (2) If the original unit has been re-installed or when a satisfactory check on a new unit has been completed, carry out the following procedures.

R (a) Connect the centre and rear cables and install the conduits (76-21-00, Inspection/Check, para. D).

R (b) Re-arm the system (76-21-00, Inspection/Check, para.E.).

R (c) Check and, if necessary, adjust the thermal expansion compensating cylinder and piston assembly as detailed in 76-21-00, Adjustment/ Test.

R (3) Ensure that there is a minimum clearance of 0.200 in. (5.0 mm) between cable conduit and adjacent bolt head of harness tray support clamp.

R G. Check for Leaks at Connections Disturbed During Procedure.

NOTE: A leak check must be made by either using static pressure or during an engine run.

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure = comply with the procedures given in 73-12-02, ADjustment/Test, paragraph 2.

(b) PTIR pressure - comply with the procedures given in 73-12-02, Adjustment/Test, paragraph 3.

(c) On completion of static pressure test and removal of any installed test equipment,continue with the installation procedure of paragraph G. (1) to (5) and (7).

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph G.

R H. Complete the Installation.

(1) Install fuel drain tube - distribution and dump valve dump outlet to tank (Ref. Fig. 402).

(a) Apply lubricant A to attachment items.

(b) Assemble new sealing ring to the spigot groove of attachment flange.

(c) Engage tube spigot squarely with dump outlet of distribution and dump valve and screw tube union nut hand-tight to its connection at the drains tank.

(d) Locate the harness support bracket on the tube flange and secure tube flange to distribution and dump valve with three bolts lightly tightened. Locate the two longer bolts to retain bracket.

NOTE: If difficulty is experienced in assembling and securing flange to distribution and dump valve refer to S.B.OL.593-71-8482-20.

(e) Attach tube clamp assembly, together with electrical harness clamp, to support bracket with a bolt, flat washer and nut.

(f) Torque-tighten union nut to between 310 and 340 lbf in. (35 and 38 N.m) and wire-lock it.

(g) Torque-tighten bolts at tube flange to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(h) Torque-tighten tube clamp assembly retaining bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(2) Connect seal failure drains system to distribution and dump valve (Ref. Fig. 403).

(a) Apply lubricant A to fluid passage bolt and tube union nut.

(b) Position a new sealing washer at each side of connector then secure connector to distribution and dump valve with fluid passage bolt torque-tightened to between 150 and 170 lbf in. (17 and 19,2 N.m).

(c) Connect drains system tube to fluid passage bolt

and triple torque-tighten thrust wire type union nuts (Ref. 70-00-04, Torque - Tightening Technique) to between 90 and 100 lbf in (10,2 and 11,3 N.m).

(d) Wire-lock tube union nuts and fluid passage bolt.

(3) On Engines No.1 and No.3, secure electrical harness support tray and tie-rod at the engine mounted brackets (Ref.71-00-12, Removal/Installation).

(4) On Engines No.2 and No.4, install section of cross-feed duct, intercommunication valve to housing (Ref.71-00-12, Removal/Installation).

(5) Remove safety clips, reset circuit breakers (Ref. Table 401) and open LP fuel isolation valve.

(6) Check for leaks during an engine run if a static pressure leak check procedure was not carried out.

(a) Start appropriate aircraft fuel feed pumps and carry out a preliminary leak check at connections and the seal drains outlet at drains tank over-flow vent. No leaks are acceptable. On complet-ion of check, switch off the aircraft fuel feed pumps.

(b) Reset the circuit breakers, tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing), that are required for the engine run checks and comply with the procedures of 71-00-00 and 73-00-00, Adjustment/Test respect-ively. On completion of engine run, retrip circuit breakers and attach safety clips.

(7) Close the engine bay doors (Ref.71-00-00, Servicing).

FUEL DISTRIBUTION AND DUMP VALVE - ADJUSTMENT/TEST

1. General

This chapter includes leak check procedures and functional test procedures.

The leak check procedures detailed in paragraphs 2 and 3 are complementary to the distribution and dump valve Removal/ Installation procedures. Paragraph 2 details the leak checks using the aircraft fuel feed pumps and paragraph 3 details the leak checks using the pressure test and inhibiting rig (PTIR).

The functional test procedure, given in paragraph 4, is used in conjunction with the trouble shooting procedure for the fuel system dump valve and is given as an isolated task.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Leak Check with Aircraft Fuel Feed Pumps

A. General

The distribution and dump valve and associated connections are leak checked, using the appropriate aircraft fuel feed pump and electric starter pump, in conjunction with the procedures detailed in 73-00-00, Adjustment/Test.

B. Tools and Equipment.

Pressure test equipment items (contained in adapter set
R PE.29964) are required as follows:

Air bleed tube	PE.22898
Blank	PE.35092
Blank/bleed valve	PE.35065
Blanking unit (2)	AS.15826

C. Prepare to Leak Check Distribution and Dump Valve and Associated Connections.

(1) Electrically isolate the T1 PROBE HEATER and the RH and LH IGNITION SUP circuit breakers (Ref. Table 501) by tripping the breakers affecting the engine upon which work is to be carried out. Attach safety clips.

breakers (Ref. Table 501) by tripping the breaker affecting the engine upon which work is to be carried out. Attach safety clips.

WARNING: WHENEVER ENGINE HP CONTROL CIRCUIT BREAKER IS TO BE TRIPPED OR HP VALVE SWITCH IS SET TO OPEN, FIRST TRIP ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER AND PREVENT UNNECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMPERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No. 1			
T1 PROBE HTR SUP	13-215	1H542	C 9
RH IGNITION SUP	1-213	1J4	N 5
LH IGNITION SUP	2-213	1J3	E12
Engine No.2			
T1 PROBE HTR SUP	14-215	2H542	E 8
RH IGNITION SUP	1-213	2J4	P 5
LH IGNITION SUP	2-213	2J3	B10
Engine No.3			
T1 PROBE HTR SUP	14-216	3H542	C14
RH IGNITION SUP	1-213	3J4	Q 5
LH IGNITION SUP	2-213	3J3	B11
Engine No.4			
T1 PROBE HTR SUP	13-216	4H542	C11
RH IGNITION SUP	1-213	4J4	R 5
LH IGNITION SUP	2-213	4J3	E13

Circuit Breakers
Table 501

(2) Install the following items of test equipment as detailed for each individual item in 73-00-00, Adjustment/Test, para 6.B.

(a) AS.15826 - blanking unit (Ref. Fig. 501) (detail F). Install a blanking unit on each of the fuel atomizing pilot nozzle tube junction connections.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 502). Install items in outlet connections of distribution and dump valve.

(3) Direct free ends of drain tubes into a container.

(4) Ensure that tubes at distribution and dump valve seal drain outlet and dump drain outlet are detached for leak check (Ref.73-12-02, Removal/Installation).

D. Leak Check Distribution and Dump Valve and Associated Connections.

(1) Pressurize and leak check the system up to the HP shut-off valve.

(a) Remove the safety clips and reset circuit breakers stated in 73-12-02, Removal/ Installation, Table 401. Verify that RH and LH IGNITION SUP circuit breakers given in this topic remain tripped.

(b) Ensure that all fuel connections are secure, open the LP fuel isolation valve and start the appropriate aircraft fuel feed pumps.

(c) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) With feed pump pressure applied, check for signs of leakage at bleed valve, blanking ferrules and the drains outlets of the engine connections under test. No leaks are acceptable.

(2) Pressurize and leak check the system between the HP shut-off valve and the distribution and dump valve outlet connections.

(a) Select the HP VALVE switch OPEN and energize the start solenoid valve.

(b) Bleed air from the system by means of the bleed valve in the blank/bleed valve installed in the distribution and dump valve drain outlet.

(c) When system is free of air close valve and check

system for signs of leakage. If a leak should occur from dump drains outlet refer to paragraph (5). No other leaks are acceptable.

(3) Pressurize and leak check the electric starter pump supply to fuel atomizing (pilot) nozzle assembly tube connections at distribution and dump valve.

(a) Select the ENGINE DEBOW switch to DEBOW.

(b) Select the RELIGHT/START switch to START.

(c) Check connections for signs of leaks. No leaks are acceptable.

(4) On completion of check, switch off pumps.

(a) Select ENGINE DEBOW switch to NORMAL.

CAUTION: DO NOT SELECT ENGINE DEBOW SWITCH TO DEBOW WITHIN ONE MINUTE OF SELECTING RELIGHT/START SWITCH OFF.

(b) Select RELIGHT/START switch to OFF if not already unlatched.

NOTE: Electric starter pump will remain 'ON' for approxiamtely 30 seconds after RELIGHT/START switch has been selected OFF.

(c) Select HP VALVE switch to SHUT.

(d) Switch off the aircraft fuel feed pumps.

(5) If any doubt exists whether any leakage rate from the dump outlet is acceptable, carry out an accurate leak rate check as detailed in 73-00-00, Adjustment/Test.

(6) If a seal failure drains connection leakage should occur:

(a) Establish the location of the defective seal by reference to the illustration (Ref. Fig. 503).

(b) Renew a defective seal or component and then repeat the leak check.

E. Remove Pressure Test Equipment and Install/Connect Engine Components.

(1) Remove the following items of test equipment and install/connect engine components as detailed for each individual item in 73-00-00, Adjustment/Test, para.6.D.

(a) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

(2) Ensure that bleed valve dust cap seal is in place and assemble cap to valve. Tighten and wire-lock cap.

(3) Remove safety clip and reset circuit breaker (Ref. Table 501).

3. Leak Check Using PTIR

A. General

This paragraph details the procedure for a pressure test and leak check using the PTIR and pressure test equipment. On completion of the PTIR checks a final leak check is required using the aircraft fuel feed pumps to check remade connections after removal of test equipment.

B. Tools and Equipment.

Pressure test and inhibiting rig (PTIR)... ... PE.17988

Pressure test equipment (contained in adapter set PE.22964 are required as follows:

Air bleed tube PE.22898

Adapter (Pre S.B.OL.593-73-1 drain valve) PE.22972

Adapter (S.B.OL.593-73-1 drain valve) ... PE.26710

Blank PE.20757

Blank PE.35092

Blank/bleed valve PE.35065

Blanking unit (2) AS.15826

Blanking plug	PE.29937
Clamp	PE.27277
Drain adapter	PE.20748
Drain adapter	PE.27080
Drain adapter	PE.35666
Drain adapter (use in conjunction with AS.15826)	PE.29693
Hose	PE.22893
Hose	PE.28394
Drain tube (Pre S.B.OL.593-73-1 drain valve) ...	PE.34076
Drain tube (S.B.OL.593-73-1 drain valve) ...	PE.26796

C. Test Fluid

Aviation kerosine	D.Eng.R.D.2494
or	
Inhibiting fluid	DEF.2001A or D.Eng.R.D.2490

D. Drain the Inlet Section of the System.

(1) Open bleed valve to expedite draining.

(2) Use drain tool PE.34076 (Pre S.B.OL.593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve. Direct free end of drain tube into a container and drain the system upstream of the fuel heater and filter.

(3) When drain ceases, remove the drain tube and close the bleed valve.

(4) Discard drained fuel or inhibiting fluid.

E. Install Pressure Test Equipment.

(1) Install the following items of test equipment as detailed for each individual item in 73-00-00, Adjustment/Test para 6.B.

(a) PE.20757 - blank and PE.27277 - clamp

CR 31229/00 B

CLAMP
BLANK
FUEL INLET ELBOW
A
B
INLET ELBOW DRAIN ADAPTER
A
DRAIN VALVE
ADAPTER SB.73-1
COVER
HOSE ASSEMBLY
SEALING RING
ADAPTER PRE SB.73-1
THROTTLE VALVE ACTUATOR GEARBOX
DRAIN ADAPTER ASSEMBLY (INCORPORATING RELIEF VALVE)
B

CMR 73 12 02 5 AAMA

Installation of Test Equipment and Location
(Sheet 1 of 2)
Figure 501

CR 31336/00C

F

E

EJECTOR PUMP OUTLET

BLANKING PLUG

FIRST STAGE PUMP

E

FUEL ATOMIZING PILOT
NOZZLE TUBE JUNCTION

BLANKING
PLUG

DRAIN ADAPTER

F

CMR 73 12 02 5 AAMB

Installation of Test Equipment and Location
(Sheet 2 of 2)
Figure 501

(Ref. Fig. 501) (detail A). Install in fuel inlet elbow.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 adapter (S.B.OL.593-73-1 drain valve) (Ref. Fig. 501) (detail A). Assemble hose and adapter to fuel inlet elbow drain valve location.

(c) PE.29937 - blanking plug (Ref. Fig. 501) (detail E). Install in the return fuel tube at outlet to ejector pump/first stage pump.

(d) PE.35666 - drain adapter (Ref. Fig. 501) (detail B). Install adapter in the throttle valve actuator gearbox spill/drain plug location.

(e) PE.20748 - drain adapter (Ref. Fig. 501) (detail A). Assemble drain adapter to fuel inlet elbow drain connection.

(f) AS.15826 - blanking unit and PE.29693 - drain adapter (Ref. Fig. 501) (detail F). Install items on fuel atomizing pilot nozzle tube junction connections.

(g) PE.28394 - hose (Ref. Fig. 502). Connect hose to connection on servo fuel tube near connection to distribution and dump valve.

(h) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 502). Install items in fuel outlet connections of distribution and dump valve.

(j) PE.27080 - drain adapter (Ref. Fig. 502). Install adapter in distribution and dump valve dump outlet.

(2) Direct free ends of drain tubes into a container.

F. Pressure Test Procedure.

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple the two self-sealing hoses of the test

Installation of Test Equipment at
Distribution and Dump Valve
Figure 502

rig to the installed test adapter hoses at the inlet elbow and the servo fuel tube.

(c) Verify that the weight of each hose is supported and that all connections are secure before commencing test procedure.

(d) Apply pressures slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence the test procedure.

(2) Bleed all air from the system and continue with the low pressure test, paragraph (3).

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

(b) Install air bleed tube PE.22898, open the air bleed valve and allow to bleed until an air free fuel flow is obtained and then close the valve. Allow a short settling period and repeat the bleed process to ensure that the second stage pump region is air free and again close the valve and remove air bleed tube.

(c) Open bleed valve of manifold blank/bleed valve and allow to bleed until an air free flow is again obtained and then close bleed valve.

(3) Carry out the low pressure test.

(a) With 30 psig (207 kPa) pressure applied, check leakage rates from the fuel atomizing pilot nozzle tube. Measure leakage from drain adapter. The maximum acceptable leakage rate is 5 cc/h.

(b) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage and ensure that the following conditions are met before commencing the high pressure test.

(b1) No leakage from the primary static seals is acceptable. If a leak shows from the disconnected outlets of the seal failure drains system, find defective seal(s) by a process of elimination (Ref.para.G.).

NOTE: A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

(b2) There should be no spill from the actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

(c) Blank fuel atomizing pilot nozzle tube for further pressure test (Ref. Fig. 501) (detail F).

(c1) Remove drain adapter and install blanking unit AS.15826 torque-tightened to between 190 and 210 lbf in. (21,5 and 23,5 N.m) (lubricant A).

(4) Continue with a high pressure test.

(a) Operate the test rig and increase the test pressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check the disconnected seal failure drains connections for signs of leaks. No leaks are acceptable. If a leak is disclosed, find defective seal(s) by a process of elimination (Ref.para.G.).

NOTE: The seal drains connections at the distribution and dump valve and fuel inlet elbow are interconnected internally to more than one seal.

(d) Maintain the pressure long enough to measure accurately leakage from the installed drain adapters. Use a graduated measuring jar and stop watch. The acceptable limits are as follows:

(d1) Quick shut-down (emergency dump valve ... ... 20 cc/min

(d2) Manifold normal dump valve ... ... 10 cc/min

(e) If spill from actuator gearbox appears

excessive (100 cc/min maximum acceptable limit) carry out an accurate leak rate check as detailed 73-00-00, Adjustment/Test.

(f) Reduce test to zero and stop pump motor.

(5) On completion pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hoses. Open the bleed valves to expedite draining.

CAUTION: ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED. FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

G. Procedure to Locate and Rectify a Leak.

(1) Should the leakage rate from either the manifold normal dump valve, the quick shut-down emergency dump valve or the pilot nozzle system via the fuel atomizing pilot nozzle tube be excessive, rectify by renewal of distribution and dump valve.

(2) Should a leak from a seal be disclosed, locate the defect and rectify it by renewal of seal plate or component. Refer to 73-11-01, Adjustment/Test to identify seals connected to fuel inlet elbow drains connection. The distribution and dump valve seal failure drains outlet connects internally to the following seals.

(a) FCU to distribution and dump valve rear face fuel servo spill tube seal.

(b) FCU to distribution and dump valve fuel servo tube seal.

(c) FCU fuel tube union to distribution and dump valve rear face fuel servo spill tube seal.

(d) Thermometer unit face seal.

(e) Upper fuel manifold connection to distribution block and dump valve seal.

(f) Lower fuel manifold connection to distribution and dump valve seal.

(g) Engine fuel flowmeter fuel inlet connection seal.

(h) Engine fuel flowmeter fuel outlet connection

seal.

(j) Starter pump to distribution and dump valve fuel tube seal.

(k) Distribution and dump valve to fuel atomizing pilot nozzle tube seal.

(l) Blanking plate seal.

(3) The following procedures will enable defective item to be identified.

(a) Distribution and dump valve seal failure drains connection leakage (Ref. Fig. 503).

(a1) Remove each drain duct cover plate, in turn, and determine (with test pressure applied) from which individual ports the fuel leakage occurs. Install the cover after each check. Establish the location of the defective seal by reference to the illustration.

(a2) Release test pressure.

(a3) Renew a defective seal or component as detailed in the relevant chapter and then repeat the pressure test and leak check.

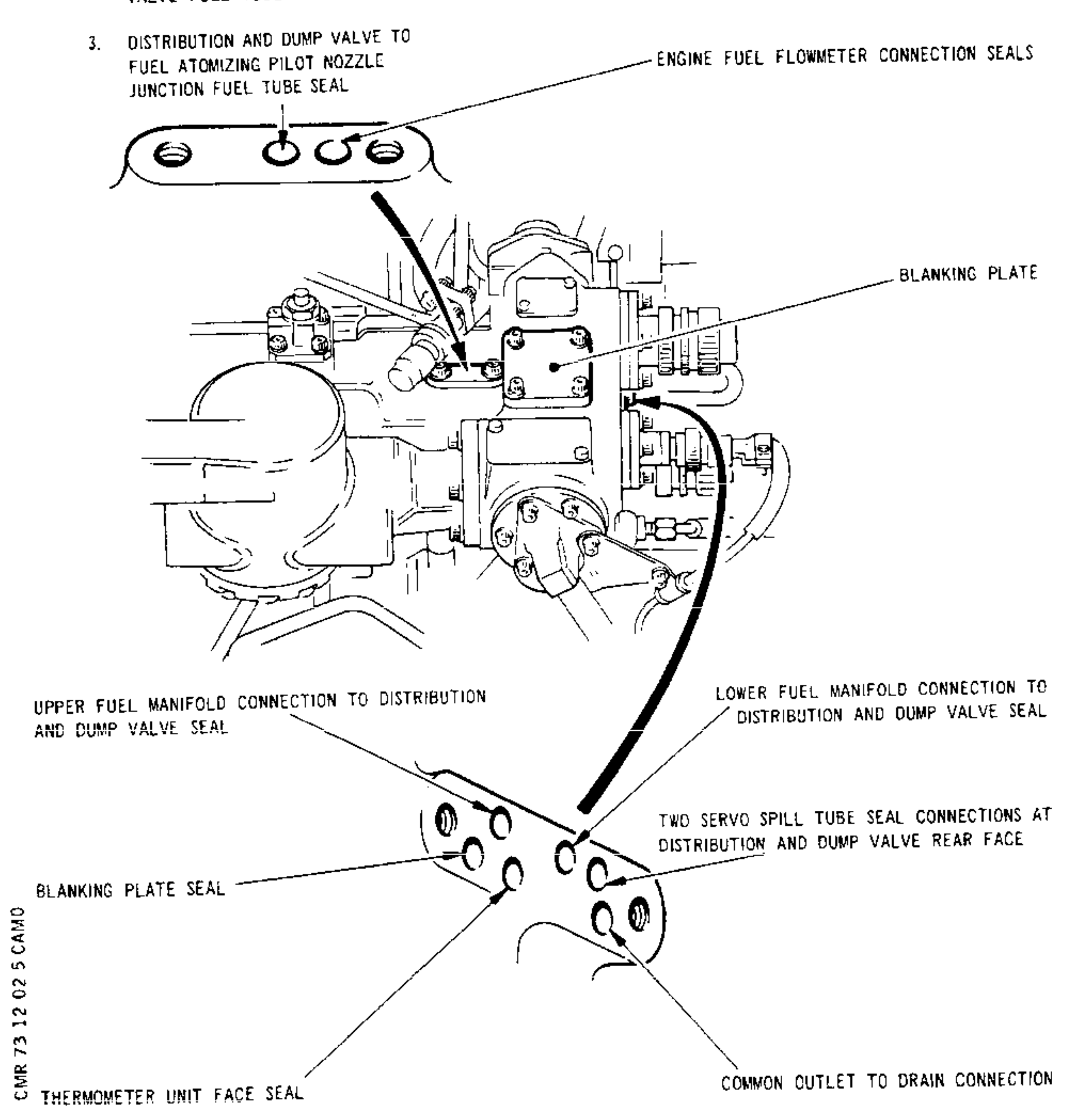
H. Remove Test Equipment and Install/Connect Engine Components.

(1) Remove the following items of test equipment and install engine components as detailed for each individual item in 73-00-00, Adjustment/Test, paragraph 6.D.

NOTE: If an engine is to be inhibited, refer to 70-00-07 Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(a) PE.20757 - blank and PE.27277 - clamp ring. Remove blank and clamp ring and reconnect the aircraft/engine main fuel connection.

(b) PE.22893 - hose and PE.22972 = adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve). Remove



Distribution and Dump Valve Seal Failure
Drains Transfer Passenger
Figure 503

hose and adapter and install drain valve.

(c) PE.29937 - blanking plug. Remove plug and install blanking ferrule at ejector pump.

(d) PE.35666 - drain adapter. Remove adapter and install the blanking plug in the actuator gearbox.

(e) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

(f) PE.28394 - hose. Detach hose adapter and install blanking ferrule to connection on servo fuel tube.

(g) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

(2) PE.27080 - drain adapter (Ref. Fig. 502). Remove drain adapter from distribution and dump valve. Ensure that flat seal remains attached to adapter.

(3) Carry out a final leak check.

(a) Carry out a final leak check as detailed in paragraph 2.D.(1).

NOTE: The manifold flight standard blanking ferrules cannot be leak checked using aircraft feed pump pressure.

(b) On completion of check, switch off the aircraft feed pumps.

(4) PE.20748 - drain adapter. Remove drain adapter from inlet elbow and connect the seal drains system as detailed in 73-00-00, Adjustment/Test, paragraph 6.D.

(5) Ensure that seal is in place and assemble the dust cap to the air bleed valve. Tighten the cap and wire-lock it.

(6) Assemble pressure cap with new seal to the fuel inlet elbow drain valve. Tighten the cap and wire-lock it.

(7) Complete the procedure as detailed in 73-12-02, Removal/Installation.

4. Functional Test of Dump Valve

A. Tools and Equipment.

Test set, fault diagnosis	S3S.12408000
Air bleed tube	PE.22898
Blank	PE.35092
Blank/bleed valve	PE.35065
Blanking unit (2)	AS.15826
Circuit breaker safety clip	-

B. Prepare for Functional Test of Dump Valve.

(1) Open engine bay front and rear lower doors of an installed engine (Ref.71-00-00, Servicing).

(2) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

(3) Electrically isolate the engine additional services indicated in Table 501 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

WARNING: WHENEVER ENGINE HP CONTROL CIRCUIT BREAKER IS TO BE TRIPPED OR HP VALVE SWITCH IS SET TO OPEN, FIRST TRIP ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER AND PREVENT UNNECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMPERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

SERVICE	PANEL IDENT.	CIRCUIT BREAKER IDENT.	MAP REF.
Engine No.1			
T1 PROBE HTR SUP	13-215	1H542	C9
RH IGNITION SUP	1-213	1J4	N5
LH IGNITION SUP	2-213	1J3	E12
HP VALVE POSN IND	15-216	E214	A10
HP VALVE PSN AMP SUP	13-216	E211	A6

R

R	SERVICE	PANEL IDENT.	CIRCUIT BREAKER IDENT.	MAP REF.
R	LP VALVE SUP 1	15-216	1Q1	C1
R	LP VALVE SUP 2	16-215	1Q2	-
R	<u>Engine No.2</u>			
R	T1 PROBE HTR SUP	14-215	2H542	E8
R	RH IGNITION SUP	1-213	2J4	P5
R	LH IGNITION SUP	2-213	2J3	B10
R	HP VALVE POSN IND	15-215	E213	B17
R	HP VALVE POSN AMP SUP	13-215	E212	G13
R	LP VALVE SUP 1	15-216	2Q1	F2
R	LP VALVE SUP 2	15-215	2Q2	C19
R	<u>Engine No.3</u>			
R	T1 PROBE HTR SUP	14-216	3H542	C14
R	RH IGNITION SUP	1-213	3J4	Q5
R	LH IGNITION SUP	2-213	3J3	B11
R	HP VALVE POSN IND	15-215	E213	B17
R	HP VALVE POSN AMP SUP	13-215	E212	G13
R	LP VALVE SUP 1	15-216	3Q1	F1
R	LP VALVE SUP 2	15-215	3Q2	C20
R	<u>Engine No.4</u>			
R	T1 PROBE HTR SUP	13-216	4H542	C11
R	RH IGNITION SUP	1-213	4J4	R5
R	LH IGNITION SUP	2-213	4J3	E13
R	HP VALVE POSN IND	15-216	E214	A10
R	HP VALVE POSN AMP SUP	13-216	E211	A6
R	LP VALVE SUP 1	15-216	4Q1	C2
R	LP VALVE SUP 2	16-215	4Q2	-
R				

R Circuit Breakers
R Table 502 (Concluded)

R (4) Install the following blanks as detailed in 73-00-00,
R Adjustment/Test, para.6.B.

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(a) AS.15826 - blanking unit (Ref. Fig. 501), (detail F). Install a blanking unit on each of the fuel atomizing pilot nozzle tube junction connections.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 502). Install items in outlet connections of distribution and dump valve.

(c) Direct free end of drain tube into a container.

C. Check Dump Valve Operating (Servo) Pressure.

(1) Connect the test set to the dump valve test point on the servo fuel tube for the test procedure.

(a) Remove the tube closure ferrule from the test point at the servo fuel tube connection (Ref. Fig. 502).

(b) Assemble the test adapter (S3S.12408001) to the test point connector and tighten securely.

(c) Connect the test set hose to the adapter and tighten securely.

(d) Connect the test set earth and direct the test set bleed tube into a container.

(e) Remove the safety clips and reset the LP VALVE circuit breakers (Ref. Table 502). Verify that RH and LH IGNITION SUP circuit breakers remain tripped.

(f) Ensure that all fuel connections are secure, open the LP fuel isolation valve and start the appropriate aircraft fuel feed pumps.

(g) Select HP VALVE switch OPEN and energize the start solenoid valve.

(h) Bleed air from the system and test set.

R (h1) Open the bleed valve in blank/bleed valve and close valve when fuel flows free of air.

R (h2) Open the test set bleed valve and close firmly when fuel flows free of air.

(2) Pressurize the dump valve and check the applied

pressure.

(a) Select the ENGINE DEBOW switch to DEBOW.

<u>CAUTION</u>: KEEP STARTER PUMP RUNNING TO MINIMUM AND DO NOT EXCEED MAXIMUM OF FIVE MINUTES.

(b) Select the RELIGHT/START switch at START.

(c) Observe and record the pressure registered on the test set gauge.

Minimum acceptable pressure... ... 45 p.s.i.g.

(d) Select ENGINE DEBOW switch to NORMAL.

<u>CAUTION</u>: DO NOT SELECT ENGINE DEBOW SWITCH TO DEBOW WITHIN ONE MINUTE OF RELIGHT/ START SWITCH RETURNING TO OFF.

If RELIGHT/START switch doew not automatically return to OFF, select OFF.

(e) Switch off feed pumps and close the LP fuel isolation valve.

(3) Continue with the procedure in the relevant Trouble Shooting chapter/topic and remove the test equipment as detailed in paragraph D.

D. Remove Test Equipment and Restore to Flight Standard.

(1) On completion of check, remove test equipment and install blanking tube closure ferrule.

(a) Verify that LP fuel isolation valve is closed and trip the LP VALVE circuit breakers (Ref. Table 502).

(b) Drain the dump valve and test set. Open the test set bleed valve, slacken union nut at dump valve test connection and allow fuel to drain. Close bleed valve and discard drained fuel.

(c) Disconnect test set hose from adapter and remove adapter from dump valve test connection of servo fuel tube and torque-tighten to between 190 and 210 lbf in. (21,5 and 23,7 N.m) with lubricant A applied.

R (d) Screw tube closure ferrule on dump valve test connection, tighten securely and wire-lock.

R (e) Wire-lock nut of closure ferrule.

R (2) Pressurize and leak check drain and bleed valves and the dump valve test connection concurrently with and other fuel system leak checks. Comply with the following procedure separately if no other checks required.

R (a) Remove the safety clip and reset the LP fuel isolation valve circuit breaker (Ref.Table 502).

R (b) Ensure that all fuel connections are secure, open the LP fuel valve and start the appropriate aircraft fuel feed pumps.

R (c) Bleed all air from the system via the air bleed valve and bleed tube. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

R (d) With feed pump pressure applied, select HP VALVE switch OPEN, check for signs of leakage at bleed valve, blanking ferrules and the drains outlets of the aircraft/engine connections under test. No leaks are acceptable.

R (e) Select HP VALVE switch CLOSED.

R (f) On completion of check, switch off the aircraft feed pumps, close LP fuel valve and trip LP fuel isolation valve circuit breaker (Ref.Table 502).

R (3) When work is completed, remove the following items of test equipment and install engine components as detailed for each item in 73-00-00, Adjustment/Test, paragraph 6.D.

R (a) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

R (b) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

R (4) Remove safety clips and reset circuit breakers

R detailed in Table 502.

R (5) Close engine bay doors (Ref.71-00-00, Servicing).

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FUEL INLET ELBOW AND DRAIN VALVE - REMOVAL/INSTALLATION

1. General

This chapter details the removal procedures for the inlet elbow and drain valve as an assembly in paragraph 3, and the drain valve as a separate item in paragraph 4.

R R Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Air bleed tube	PE.22898
R Drain tube (Pre S.B.OL.593-73-1 drain valve)	PE.34076
R Drain tube (S.B.OL.593-73-1 drain valve) ...	PE.26796
Circuit breaker safety clip	-

3. Fuel Inlet Elbow

A. Prepare to Remove Elbow.

R R (1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front doors on engines No. 1 and No. 3, and open front lower doors on engines No. 2 and No. 4 (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
Engine No.2			
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.3			
LP VALVE SUP 1	15-216	3Q1	F1
LP VALVE SUP 2	15-215	3Q2	C20
Engine No.4			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 401

(4) Drain inlet section of engine fuel system.

R (a) Open bleed valve to expedite draining.

R (b) Use drain tube PE.34076 (Pre S.B. OL.593-73-1
R drain valve) or PE.26796 (S.B.OL.593-73-1 drain
R valve) at the inlet elbow drain valve and
R drain the system upstream of the fuel heater and
R filter.

(b) When fuel drain ceases, remove the drain tube
R and close the bleed valve.

NOTE: Discard drained fuel or inhibiting fluid.

B. Remove Elbow (Ref. Fig. 401)

R (1) Disconnect aircraft/engine main fuel connection and
R move aircraft tube elbow away from inlet elbow.

R (2) Disconnect seal failure drains system tubes and remove fluid passage bolt, connector and seal washers.

R (3) Remove bolts securing fuel return tube to inlet elbow and extract seal plate.

R (4) Remove support links.

(a) Remove long link and its attachment items and retain together.

(a1) Remove bolt securing link to heater.

(a2) Remove nut and flat washer and withdraw bolt and locking plate from lower end of link.

(a3) Remove link and bush assemblies complete, ensuring that the shims are not displaced from bush at upper end of link.

(a4) Remove shims and headed bush, and eccentric bush from link ends.

(b) Remove two short support links and their attachment items and retain each group together.

(b1) Remove bolt securing upper link to heater.

(b2) Remove bolt securing lower link to heater and filter.

(b3) Remove nut, flat washer and bolt securing the upper link to the inlet elbow and remove link with its headed bushes and shims. Separate shims and headed bushes from the link.

(b4) Remove nut, flat washer and bolt securing the lower link to the inlet elbow and remove link with its headed bush and shims. Separate shims and bush from the link.

(5) Remove attachment bolts and detach inlet elbow and seal plate from pump inlet.

(6) If elbow is to be renewed remove drain valve (Ref. para. 4).

C. Install Elbow.

(1) If a new elbow is to be installed, install the drain valve taken from removed elbow (Ref. para 4). Omit pressure test sequence as this is done on completion of elbow installation.

(2) Assemble new seal plate over inlet elbow spigot.

(3) Align attachment holes, inlet elbow drain valve downward, and engage spigot with first stage pump.

(4) Apply lubricant B and insert the six attachment bolts. Torque-tighten bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(5) Connect fuel return tube to inlet elbow.

(a) Position new seal plate between tube and elbow mating faces and align attachment holes.

(b) Apply lubricant B then screw in four attachment bolts.

(c) Torque-tighten bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(6) Install the upper short support link (Ref. Fig. 402), (detail B).

(a) Assemble link outer end to inlet elbow.

(a1) Assemble eight shims to headed bush.

(a2) Assemble headed bush to link.

(a3) Apply lubricant B and insert attachment bolt through headed bush, link and inlet elbow then assemble flat washer and nut. Lightly tighten nut.

(b) Assemble link inner end to heater.

(b1) Align attachment holes.

(b2) From the set of eleven shims removed with link, select the number required to fill gap between adjacent faces of link and heater.

(b3) Place remaining shims of set over headed bush and assemble bush to link with selected shims between link and heater.

(b4) Apply lubricant B and secure the

CR 30497/00B

FUEL HEATER AND FILTER

A
S.B. 71-10

UPPER SHORT
SUPPORT LINK

LONG
SUPPORT LINK

FIRST STAGE PUMP INLET

CMR 73 12 03 4 AAM0

SEAL PLATE

FUEL INLET ELBOW

A

A
PRE S.B. 71-10

LOWER SHORT SUPPORT LINK

Fuel Inlet Elbow Removal
Figure 401

R

assembly with a bolt torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(c) Torque-tighten nut on bolt securing link to inlet elbow to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(7) Install the lower short support link (Ref. Fig. 402), (detail A).

(a) Assemble link inner end to heater.

(a1) Apply lubricant B to retaining bolt.

(a2) Insert bolt through link to engage with heater and lightly tighten.

(b) Assemble link outer end to inlet elbow.

(b1) Align attachment holes.

(b2) From set of nine 0.010 in. shims removed with link, select the number required to fill the gap between adjacent faces of link and elbow.

(b3) Place remaining shims of set over headed bush and assemble bush to link with selected shims between link and elbow faces.

(b4) Insert bolt through bush from headed side, assemble washer and nut to bolt. Torque-tighten nut to between 85 and 95 lbf in. (9,6 and 10,7 N.m) using lubricant B.

(c) Torque-tighten bolt securing link to heater to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(8) Install long support link (Ref. Fig. 402), (detail C).

(a) Determine number of shims required between link upper attachment and heater unit.

(a1) Assemble eccentric bush in link lower attachment hole, aligning one slot in bush and link face. Engage lockplate with aligned slots.

CR 31076/00B

HEADED BUSH

HEATER AND FILTER

HEADED BUSH

SHIMS

B

SHIMS

SHIMS

INLET ELBOW

C

HEATER AND FILTER

HEADED BUSH

INLET ELBOW

A

SHIMS

INLET ELBOW

ECCENTRIC BUSH

LOCK PLATE

CMR 73 12 03 4 BIAMO

FLATWASHER

Support Link Installation Adjustment
Figure 402

(a2) Position link on elbow flange and secure with bolt washer and nut.

(a3) From set of eleven 0.010 in. shims removed from link, select the number required to fill gap between adjacent faces of link and heater with attachment holes aligned as near as possible.

(a4) Remove link from engine.

(b) Position remaining shims of set not required to fill gap over top attachment headed bush. Insert bush through link top attachment hole with head on same side of link as slots at other end.

(c) Place selected shims to fill gap over bush end. Apply lubricant B to bolt, position link and secure with bolt lightly tightened.

(d) Assemble link lower end to inlet elbow.

(d1) Align holes in link and elbow.

(d2) Engage eccentric bush with link hole and rotate it until it freely engages with attachment hole.

(d3) If a slot in bush does not align with a slot in link face adjust bush to bring two nearest slots into alignment.

(d4) Assemble lockplate with its key engaging slot and insert bolt. Apply lubricant B and assemble flat washer and nut.

(e) Torque-tighten nut on lower attachment bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m) ensuring that lockplate remains in position in slots.

(f) Torque-tighten upper attachment bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(9) Connect and secure aircraft/engine main fuel connection at the inlet elbow as detailed in 71-00-12, Removal/Installation.

D. Check for Leaks at Connections Disturbed During Procedure.

(1) If a static pressure test for fuel leaks is to be carried out, use the aircraft fuel feed pumps.

(a) Feed pump pressure - comply with the procedures given in 73-12-03, Adjustment/Test.

(b) On completion of a static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph E.

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph E.

E. Install Seal Failure Drains System.

(1) Connect seal failure drains system to fuel inlet elbow connection.

(a) Apply lubricant A to attachment items.

(b) Assemble a new seal washer to each side of the connector, secure in position with the fluid passage bolt and torque-tighten to between 150 and 170 lbf in. (17 and 19,2 N.m).

(c) Connect seal failure drains system tubes to connector. On engines to S.B. OL.593-71-10 standard, connect one tube to fluid passage bolt.

(d) Triple torque-tighten thrust wire type union
R nuts (Ref.70-00-04, Torque-Tightening Technique) to between 90 and 100 lbf in. (10,2 and 11,3
R N.m).

(e) Wire-lock bolt and union nuts.

F. Complete the Installation

(1) If not already done during a fuel leak check procedure, remove safety clips, reset circuit breakers (Ref. Table 401) and open LP fuel isolation valve.

(2) If a leak check is to be made during an engine run carry out a preliminary leak check using the aircraft fuel feed pumps.

(a) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all

air from the system.

(b) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(c) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

(d) On completion of check, switch off the aircraft fuel feed pumps.

(3) To complete the installation and/or prepare for ground run, install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(4) If a fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing) that are required for the engine run checks, then comply with the procedures of 73-00-00 and 71-00-00, Adjustment/Test respectively. On completion of engine run, retrip circuit breakers and attach safety clips.

(5) Close engine bay doors (Ref.71-00-00, Servicing).

4. <u>Drain Valve</u>

A. General.

The drain valve is located on the underside of the fuel inlet elbow just forward of the first stage fuel pump.

B. Remove Drain Valve.

(1) Close the LP fuel isolating valve, open engine bay doors, electrically isolate fuel engine services and drain fuel as detailed in paragraph 3.A.

(2) Remove three bolts securing drain valve, and wire-locking tab attached to pressure cap chain, to inlet elbow and withdraw valve.

C. Install Drain Valve.

(1) Assemble new seal plate to drain valve and insert valve into inlet elbow location.

(2) Secure drain valve to inlet elbow with three bolts torque-tightened to betweeen 67 and 73 lbf in. (7,6 and 8,2 N.m) (lubricant B). Secure wire-locking washer, attached to pressure cap chain, with outer bolt.

D. Check for Leaks and Complete the Installation.

(1) If a static pressure test for fuel leaks is to be carried out, use the aircraft fuel feed pumps.

(a) Feed pump pressure - comply with the procedures given in 73-12-03, Adjustment/Test.

(b) On completion of a static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph 3.F.

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph 3.F.

FUEL INLET ELBOW AND DRAIN VALVE ADJUSTMENT/TEST

1. General

This procedure is complementary to the Removal/Installation of the fuel inlet elbow and drain valve and details the procedures for leak checks by application of a static pressure using the aircraft fuel feed pumps.

2. Tools and Equipment

Air bleed tube PE.22898

3. Leak Check With Aircraft Fuel Feed Pumps

A. Prepare to Leak Check Inlet Elbow and Drain Valve.

(1) If inlet elbow and drain valve assembly has been removed, disconnect seal failure drains system tubes from union adapter and connector at first stage pump connection to provide a more precise check for leaks.

(2) If drain valve only has been removed, disconnect seal failure drains system tubes at fuel inlet elbow connection to provide a more precise check for leaks.

(3) Ensure that inlet elbow drain valve pressure cap is detached.

B. Leak Check Inlet Elbow and Drain Valve

(1) Remove the safety clips and reset the circuit breakers (Ref. 73-12-03. Removal/Installation, Table 401).

(2) Ensure that all fuel connections are secure, open the LP fuel valve and start the appropriate aircraft fuel feed pumps.

(3) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(4) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valve, flanking ferrules and the drains outlets of the engine connections under test. No leaks are acceptable.

(5) On completion of check, switch off the aircraft

feed pumps.

(6) If a seal failure drains connection leakage should occur.

(a) Establish the location of the defective seal by reference to the illustration (Ref. Fig. 501)

(b) Renew a defective seal or component and then repeat the leak check.

C. Restore Engine to Flight Standard.

(1) If inlet elbow and drain valve assembly has been removed, connect seal failure drains system at first stage pump drains connection.

(a) Apply lubricant A to attachment items.

(b) Connect seal failure drains system tubes to union adapter and connector at first stage pump.

(c) Triple torque-tighten thrust wire type union nuts
R (Ref. 70-00-04, Torque-Tightening Technique) to
R between 90 and 100 lbf in.(10,2 and 11,3 N.m).

(d) Wire-lock union nuts.

(2) If drain valve only has been removed, connect seal failure drains system tubes at inlet elbow drains connection.

(a) Apply lubricant A to attachment items.

(b) Connect seal failure drains system tubes to connector at inlet elbow. On engines to S.B.OL.593-71-10 standard, connect one drain tube to fluid passage bolt.

(c) Triple torque-tighten thrust wire type union
R nuts (Ref. 70-00-04, Torque-Tightening Technique)
R to between 90 and 100 lbd in.(10,2 and 11,3 N.m).

(d) Wire-lock union nuts.

(3) Complete the procedure as detailed in 73-12-03, Removal/Installation.

CR 31382/00A

INLET ELBOW

FUEL TUBE.SPILL RETURN

FIRST STAGE PUMP

LH GEARBOX

TO HEATER AND FILTER

CMR 73 12 03 5 AAMO

DRAIN VALVE

EJECTOR PUMP

THERMOMETER

SEAL DRAINS

SEAL DRAINS

REHEAT SUPPLY

GLAND DRAIN

S/s

Fuel Inlet Elbow and First Stage Pump Seal
Failure Drains Transfer Passages and Outlets
Figure 501

FUEL PRESSURE ATOMIZING NOZZLE ASSEMBLY - REMOVAL/INSTALLATION

1. General

The nozzle assemblies are numbered as shown in the illustration (Ref. Fig. 401) No.l, 2, 7 and 8 nozzle assemblies are not accessible on any engine position with the engine installed. No.6 nozzle assembly is also inaccessible on engines in positions No.2 and No.4.

The removal/installation procedures are similar for each of the nozzle assemblies once access has been gained. No preparation is required for removal of nozzle assemblies No.1 2 and 8 when the engine is uninstalled whereas it is necessary to remove fuel, air and oil tubes for accessibility to the remainder.

The nozzle assemblies must be protected against damage at all times and protective blanks must remain in position until their removal is essential.

2. Atomizing Nozzle Assemblies - Removal/Installation (Ref. Fig. 401)

A. Prepare for Nozzle Assembly Removal.

(1) Remove engine (Ref. 71-00-12,Removal/Installation).

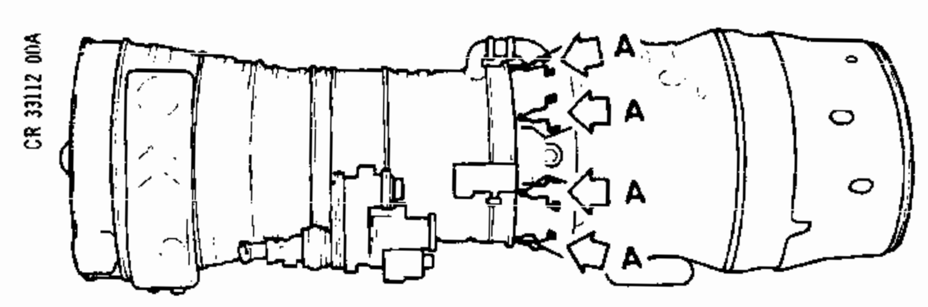
(2) Note the items to be removed for access and refer to the relevant chapter/topic for detailed removal and installation procedures. Each tube should be labelled on removal and the end and direction of lead-in for positioning on engine when installing should be noted.

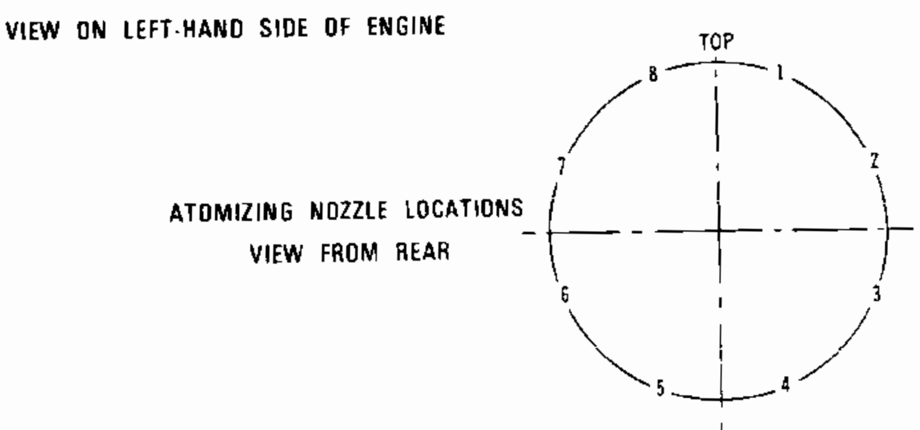
B. Remove Atomizing Nozzle Assemblies.

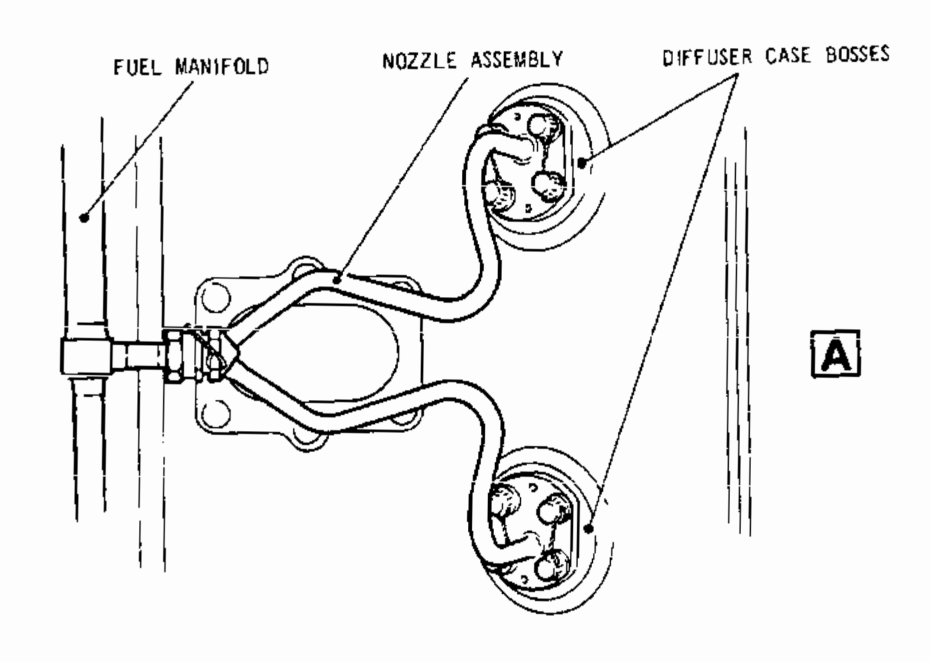
(1) Unscrew union nut securing nozzle assembly to fuel manifold and remove bolts securing nozzle assembly flanges to diffuser case. Detach brackets at locations shown.

(2) Free nozzle assembly flange joints. Tapped holes for jacking bolts are provided in the flange. Do not attempt to break joint by pulling on external feed pipes.

(3) Disengage union connection and withdraw nozzle assembly taking care not to strike discharge nozzle against the aperture side.

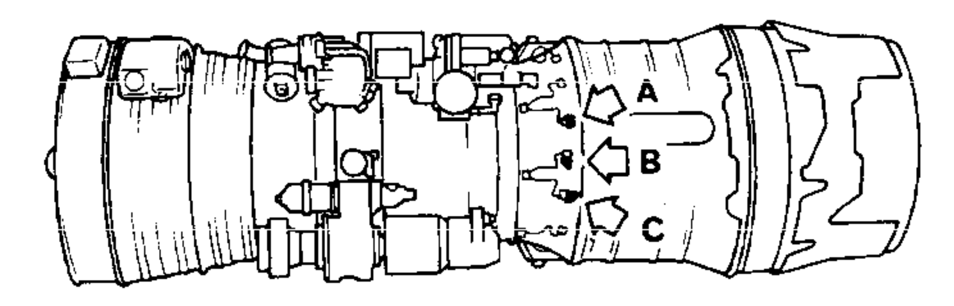




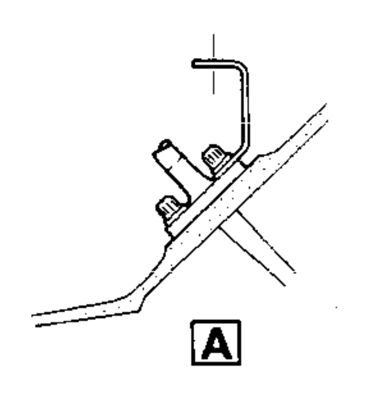


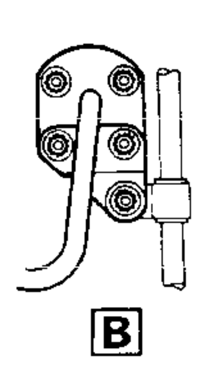
Nozzle Location and Installation Detail
(Sheet 1 of 2)
Figure 401

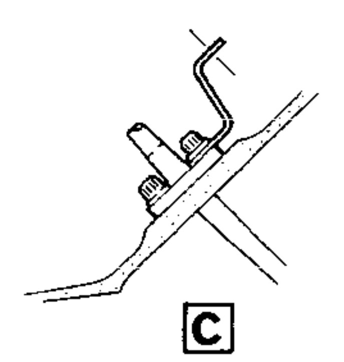
CR 33113/00A

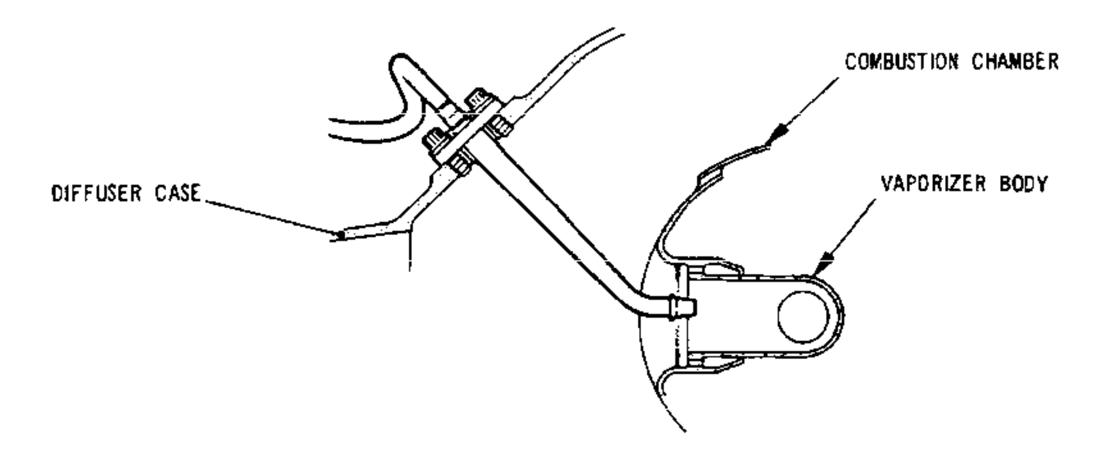


VIEW ON UNDERSIDE OF ENGINE









SECTION THROUGH ONE NOZZLE ASSEMBLY LOCATION

CMR 73 12 05 4 AAMB

Nozzle Location and Installation Detail
(Sheet 2 of 2)
Figure 401

NOTE: Disengage one discharge nozzle in advance of the other by tilting the nozzle assembly.

(4) Assemble protective blanks to each nozzle assembly as it is removed and place in a heavy gauge plastic bag.

C. Install Atomizing Nozzle Assemblies.

(1) Install each nozzle assembly separately.

(a) Remove protective blanks from nozzle assembly to be installed.

(b) Ensure injector stems and mating faces of nozzle assembly and diffuser case are clean and free from damage. Remove jointing compound adhering to joint faces from a previous application as detailed in 70-00-08, Application/Removal. If damage marks are evident refer to 73-12-05, Inspection/Check for Acceptance Standards.

(c) Apply jointing compound A to mating faces (Ref. 70-00-08, Application/Removal).

(d) Insert nozzle assembly into its location. Locate on assembly pins and engage nozzle inlet with manifold connection.

NOTE: Engage one discharge nozzle in advance of the other by tilting the nozzle assembly and avoid striking the aperture sides.

R CAUTION: IT IS ESSENTIAL THAT LUBRICANT 'C'
R IS USED ON THE APPLICABLE BOLTS/NUTS
R DURING ASSEMBLY.
R (REF. SB.OL.593-72-9044-436).

(e) Apply lubricant A to manifold union connection. Apply lubricant C to nozzle assembly attachment bolts.

(f) Screw manifold union nut on nozzle assembly connection hand tight.

(g) Assemble bolts to nozzle assembly flanges locating brackets under bolt heads where applicable (Ref. Fig.401).

(h) Torque-tighten nozzle bolts.

(i) Torque-tighten bolts to 100 lbf in (11,5 Nm).

(ii) Wait for ten minutes.

(iii) Again apply torque-tightening load to bolts and ensure tightness to required value.

(iv) Wire-lock bolts in pairs.

(j) Torque-tighten union nut to beween 250 and 280 lbf in (28,2 and 31,6 Nm). Wire-lock nut.

D. Complete the Installation.

(1) Install any items detached for access. Refer to the relevant chapter/topic for installation procedure details.

(2) Install engine (Ref. 71-00-12, Removal/Installation).

(3) Carry out the checks specified in 71-00-00, Adjustment/Test concurrent with installation ground run checks.

REHEAT INJECTION SYSTEM - REMOVAL/INSTALLATION

1. General

The reheat injection system is located centrally on the jet pipe thermocouple harness and access is obtained by entry into the jet pipe. Paragraph 2 details the removal and installation procedures for the reheat injection system as an assembly and paragraph 3 details the procedures for the reheat flame holder as a separate unit.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Reheat Injection System

A. Tools, Equipment and Approved Materials.

(1) Tools and equipment.

Protection cover	PE.21430
Spanner (serrated nut)	9970-515-278
Holding flange	9970-521-070
Rest stand	9970-521-074
Heating plate	-
Pouring vessel	-
Flexible pouring pipe	-
Mercury thermometer (range 0 to 250 deg C)...	-
Circuit breaker safety clips	-

(2) Approved materials.

'Flexane 3H' paraffin wax (120 grams) Manufacturer Total

B. Prepare to Remove Injection System.

(1) Open engine bay rear doors (Ref.71-00-00, Servicing).

(2) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

(3) Carry out the safety precautions and work sequences required for access to the jet pipe as detailed in 71-00-00, Servicing).

(4) Install ten segments of protection cover to blank-off exhaust diffuser.

(a) With segment handle facing rearward, press each segment in turn into position between adjacent vanes of exhaust diffuser.

(b) Thread cord through handle of each segment and secure cord by passing pennant end through loop end and pull tight.

(5) Remove the reheat arc igniter (Ref.74-22-01).

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
Engine No.2			
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19
Engine No.3			
LP VALVE SUP 1	15-216	3Q1	F1
LP VALVE SUP 2	15-215	3Q2	C20
Engine No.4			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 401

(6) Remove the reheat flame detector (Ref.76-15-02).

C. Remove Injection System (Ref. Fig. 401)

(1) Detach reheat fuel supply tube.

(a) Restrain elbow end piece with spanner and unscrew reheat fuel supply tube slotted union nut.

(b) Detach tube clamp assembly from bracket at turbine exhaust diffuser bottom right-hand side.

FORWARD
A
CR 34834/00A
SPRAY RING
JET PIPE THERMOCOUPLE HARNESS
INNER CONE
FLAME HOLDER
A
FLAME HOLDER
SPRAY RING ATTACHMENT POINT
PIN
GROOVED WASHER
LOCKING PIN
SPHERICAL JOINT FLANGE
BUSH
BUSH
ATTACHMENT RING
SERRATED NUT
ELBOW END PIECE
CMR 73 12 06 4 AAM0
PRE SB 77-11
SB 77-11

Reheat Injection System - Attachment Details
Figure 401

(2) Unscrew serrated nut and detach attachment ring.

(3) On engines to pre S.B.OL.593-77-10 and 77-11 standard, remove bolts securing spray ring bush to spherical joint flange and detach bush.

(4) On engines incorporating S.B.OL.593-77-10 and 77-11 standards, remove spray ring bush.

(a) Slacken pitot tube clamp assembly bolt.

(b) Remove bolts securing bush and support bracket to spherical joint flange.

(c) Move clamp assembly and support bracket clear of flange and detach bush.

(5) Remove injection system.

(a) Support the injection system, remove locking pins, washers and pins from the link rods retaining injection system to jet pipe thermocouple attachment mounts.

(b) Tilt injection system so that elbow end piece is clear of reheat fuel supply tube and remove the serrated nut, bush and attachment ring from elbow end piece.

(c) Progressively withdraw injection system from exhaust diffuser and remove from engine.

(6) Assemble holding flange to reheat injection system fuel feed tube.

(a) Locate injection system fuel feed tube in the orifice of the holding flange.

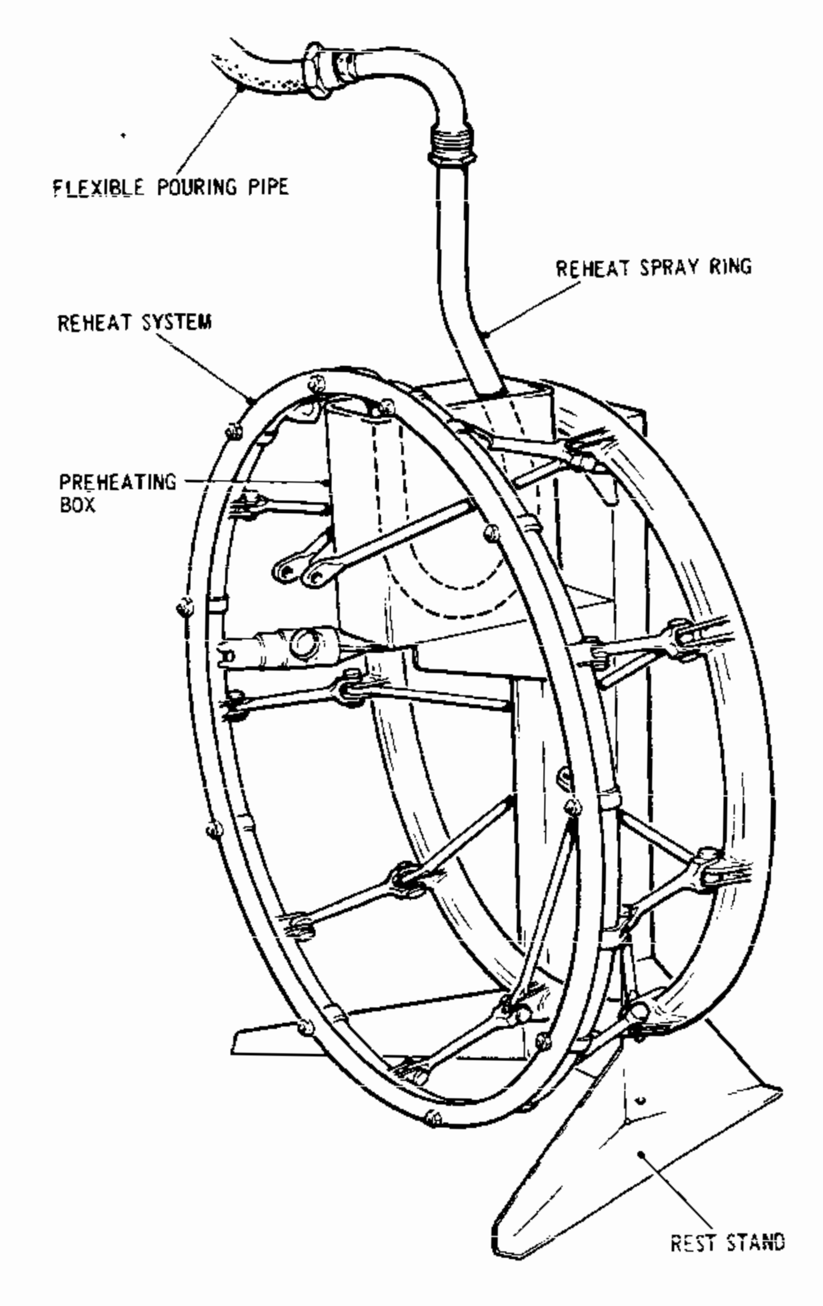
(b) Secure holding flange to flame holder with the clamp and tighten the wingnuts.

on the Rest Stand

D. Prepare to Install Injection System.

(1) Install a paraffin wax plug in spray ring pipe elbow if not already plugged (Ref. Fig.402 and 403).

(a) Clean the spray ring pipe elbow by introducing a small quantity of trichloroethane (about 0,30 l), shake, drain the pipe and dry it using

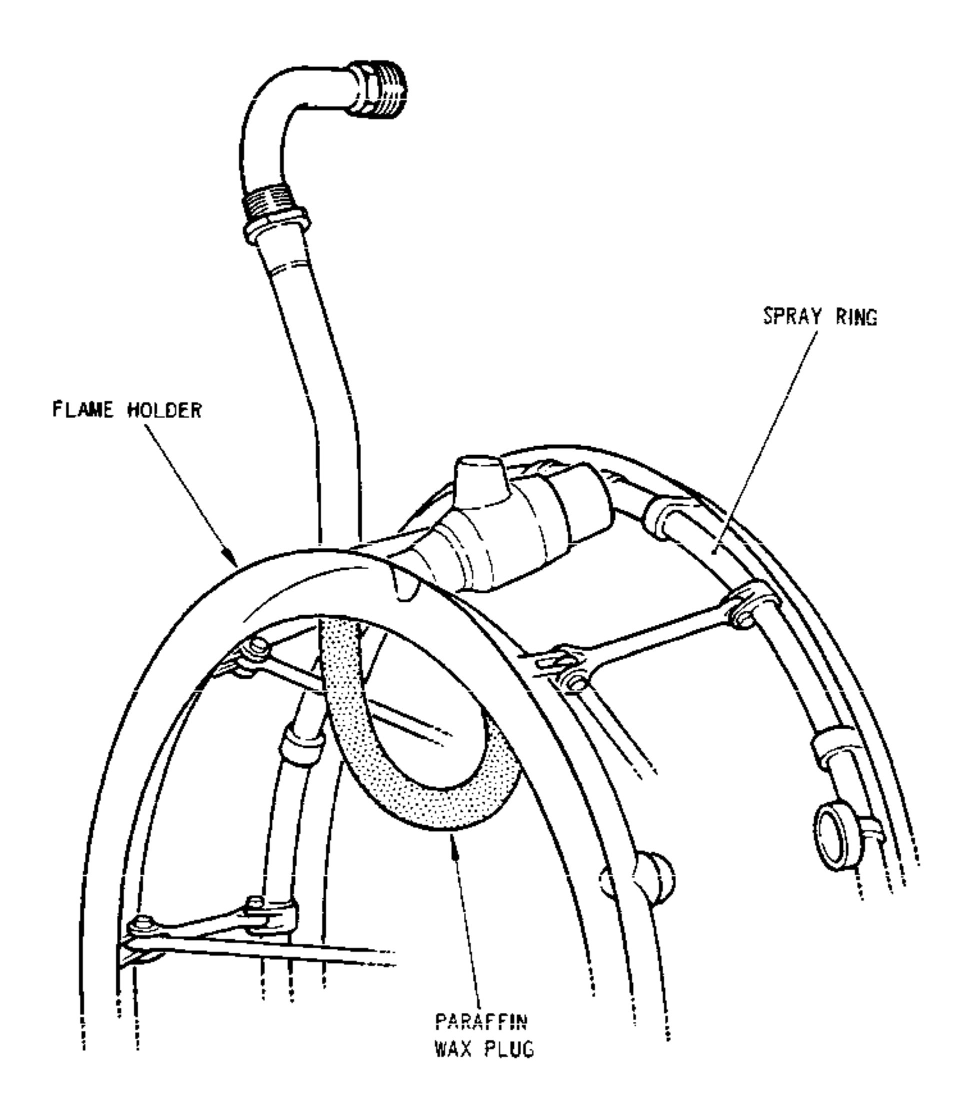


CMR 73 12 06 4 BAF0

Positioning the Reheat System
Figure 402

R

CR 31395/00C



CMR 73 12 06 4 BAMO

Spray Ring Pipe Elbow - Wax Plug Installation
R Figure 403

a compressed air supply.

(b) Remove holding flange from reheat injection system and position the spray ring on the rest stand as shown.

R (c) Fill the preheating box with boiling water to
R warm up the spray ringpipe elbow.

<u>CAUTION:</u> REJECT WAX IF TEMPERATURE RISES TO MORE THAN 150 DEG C. USE ELECTRIC HEATING DEVICE THAT ENABLES PROGRESSIVE INCREASE IN TEMPERATURE TO BE CONTROLLED.

(d) Apply heat progressively to 120 grams of paraffin wax until it is at an even temperature of between 120 and 130 deg C. Stir wax during the heating phase and ensure that the required temperature is not exceeded.

R (e) Introduce a flexible pouring pipe in the spray
R ring, pour the melted paraffin wax into the pipe.

R (f) Withdraw the preheating box from the spray ring
R bend by driving down the box support. Leave the
R spray ring in position on the rest stand to cool
R for at least one hour.

(g) Carry out a pressure test with compressed air at 6 bar (87 psig) for one minute and check the plug sealing.

(h) Remove spray ring from rest stand.

(2) When a replacement system is to be installed, check that the replacement unit pre-chamber position is suitable for the reheat igniter installed position. If necessary, transfer the light-up fuel tube/pre-chamber assembly and flame holder plug to their alternative locations (Ref. Fig. 404).

(a) Assemble holding flange to reheat injection system.

(b) Remove pin and plug from flame holder.

(c) Remove locking pin, grooved washer and pin attaching light-up fuel tube to flame holder. Push light-up fuel tube/pre-chamber towards spray ring, tilt to disengage from flame holder and

remove assembly from injection system.

(d) Engage light-up fuel tube/pre-chamber with alternative spray ring location and flame holder location in the same manner as for its removal.

(e) Attach light-up fuel tube to flame holder with pin, grooved washer and locking pin. Bend locking pin around grooved washer in a D-formation.

(f) Install plug in alternative flame holder location and retain with the pin. Bend pin legs to secure pin.

E. Install Injection System (Ref. Fig.401).

(1) If installed, release wingnuts securing holding flange clamp to injection system flame holder and remove holding flange from reheat injection system.

(2) Locate injection system on thermocouple harness and place bush, attachment ring and serrated nut in position on elbow end piece as it is progressively inserted through the spherical joint flange. Secure injection system to jet pipe thermocouple mounts with six pins.

(3) Check that the spray ring end piece does not contact any point of the spherical joint flange boss. If there is contact, centralize the thermocouple harness as detailed in 77-21-02, Removal/Installation.

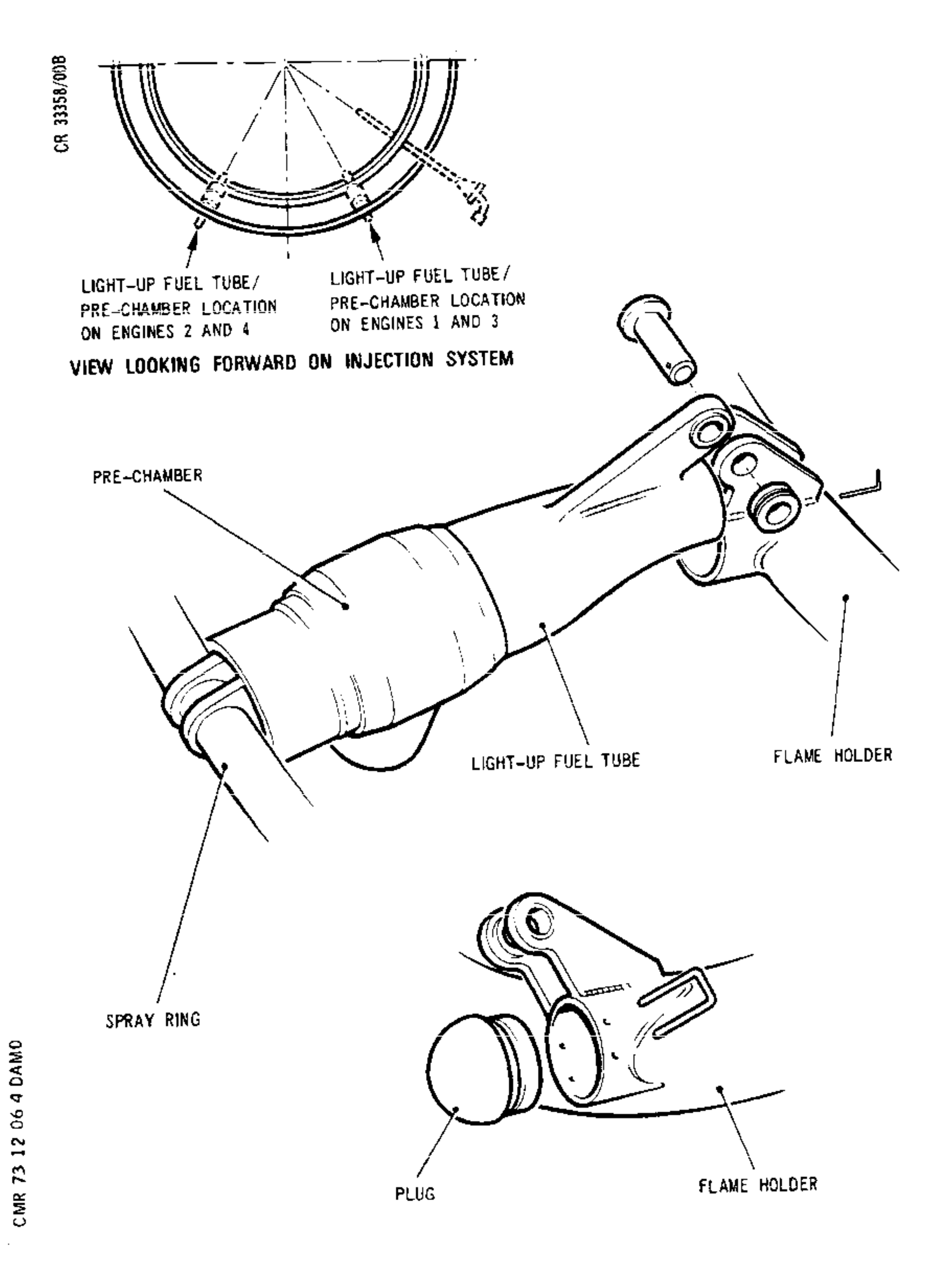
(4) Assemble grooved washers to pins at jet pipe thermocouple mounts, lock each pin with a locking pin, bend locking pin leg around washer groove.

(5) Assemble bush to spray ring.

R (a) Apply lubricant S to the bolts retaining the bush,
R and lubricant A to the pitot tube clamp bolt.

(b) On engines to pre S.B.OL.593-77-10 and 77-11 standard, position bush on spherical joint flange and retain with five keywashers and bolts lightly tightened.

(c) On engines to S.B.OL.593-77-10 and 77-11 standard, position bush on spherical joint flange and align pitot tube support bracket and clamp assembly. Retain bush and bracket with two bi-hexagon bolts at bracket attachment location and hexagon bolts with keywashers at remaining



Light-up Fuel Tube/Pre-chamber and Blanking
Plug Details
Figure 404

positions.

(d) Tighten bolts progressively in sequence to evenly dispose the load over the joint surface.

(e) Torque-tighten bolts to between 120 and 130 lbf in. (13,6 and 14,7 N.m).

(f) On engines to pre S.B.OL.593-77-10 and 77-11 standard, lock bolts with keywashers.

(g) On engines to S.B.OL.593-77-10 and 77-11 standard, lock hexagon bolts with keywashers. Wire-lock bi-hexagon bolts together. Torque-
R tighten clamp assembly bolt to 100 lbf in.
R (11,5 N.m).

(6) Secure spray ring elbow end piece to spherical joint flange.

(a) Position attachment ring on bush and ensure that ring is located on bush dowel.

(b) Apply lubricant S to serrated nut threads and screw nut onto threads of elbow end piece.

(c) Torque-tighten nut to between 510 and 550 lbf in. (57 and 63 N.m).

(7) Check that the spray ring moves freely.

(8) Check that the clearance between the spray ring curved feed tube and the nearest pair of link rods is not less than 0.118 in. (3 mm).

(9) Lock the serrated nut to attachment ring with wire.

(10) Install reheat fuel supply tube.

(a) Apply lubricant A to tube union nut and lubricant B to clamp assembly attachment items.

(b) Screw tube union nut to spray ring elbow connection by hand until the visible part of the thread is less than 0.10 in. (2,5 mm).

(c) Secure fuel tube clamp assembly to bracket at turbine exhaust diffuser bottom right-hand side with nut, washer and bolt and torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(d) Restrain elbow end piece with spanner, torque-tighten slotted union nut between 780 and 840 lbf in. (88 and 95 N.m).

R (e) Wire-lock the union nut.

F. Check for Leaks at Connections Disturbed During Procedure.

(1) A check for leaks is to be made by a static pressure test or by an engine run.

(a) If a static pressure test is to be carried out, use the pressure test and inhibiting rig (PTIR) procedure given in 73-12-06, Adjustment/Test. On completion of test and removal of installed test equipment continue with the installation procedure of paragraph G. (1) to (4) and (6).

(b) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph G.

G. Complete the Installation.

(1) Install the reheat igniter (Ref.74-22-01, Removal/Installation).

(2) Install the reheat flame detector (Ref.76-15-02, Removal/Installation).

(3) Remove protection cover from exhaust diffuser vanes.

(4) Remove servicing equipment installed in the jet pipe for access complying fully with the procedure detailed in 71-00-00, Servicing.

(5) Remove safety clips and reset LP fuel shut-off valve circuit breakers (Ref. Table 401).

(6) Carry out an engine run.

(b) Carry out the functional check procedure and, if not statically checked, the fuel leak check procedure concurrently during an engine run as specified in 71-00-00 and 73-00-00, Adjustment/ Test respectively.

(c) On completion of engine run, retrip circuit breakers and install safety clips.

(7) Close engine bay doors (Ref.71-00-00, Servicing).

3. Reheat Flame Holder

A. Tools and Equipment.

Protection cover PE.21430

Circuit breaker safety clips ... ... –

B. Prepare to Remove the Reheat Flame Holder.

(1) Carry out the safety precautions and work sequences required for access to the jet pipe as detailed in 71-00-00, Servicing.

(2) Install ten segments of protection cover to blank-off exhaust diffuser.

(a) With segment handle facing rearward, press each segment in turn into position between adjacent vanes of exhaust diffuser.

(b) Thread cord through handle of each segment and secure cord by passing pennant end through loop end and pull tight.

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

C. Remove the Reheat Flame Holder (Ref. Fig.404 and 405).

(1) Remove the locking wire pin, grooved washer and pin connecting the light-up fuel tube to the reheat flame holder.

(2) Remove the locking wire pins retaining the grooved washers on the reheat flame holder yokes.

(3) Remove the grooved washers.

(4) Remove the pins connecting the links to the reheat flame holder.

(5) Disengage the links and remove the reheat flame holder from the reheat injection system.

(6) Remove the locking wire pin and remove the plug from the unused light-up fuel tube location hole for transfer to replacement reheat flame holder.

D. Install the Reheat Flame Holder (Ref. Fig.404 and 405).

(1) Install the plug in the unused light-up fuel tube location hole and install the locking wire pin. Bend pin legs to secure pin.

(2) Position the reheat flame holder on the reheat injection system making sure that the two location holes for the light-up fuel tube are in line with the fitment on the fuel spray ring and the light-up fuel tube.

(3) Engage the links in the reheat flame holder yokes.

(4) Secure each link in turn to reheat flame holder.

R (a) Insert a pin to secure link to reheat flame holder. Ensure that pin is inserted in direction shown in the illustration (Ref. Fig. 405).

R (b) Install a grooved washer to secure pin and lock the washer with a locking wire pin. Bend the locking pin leg around the washer groove.

(5) Install the light-up fuel tube in position by sliding it into its location hole on the reheat flame holder.

<u>CAUTION:</u> MAKE SURE THAT END PIECE OF REHEAT IGNITER IS PROPERLY ENGAGED IN PRE-CHAMBER APERTURE.

(6) Install the pin and grooved washer holding the light-up fuel tube on the reheat flame holder. Lock with locking wire pin, bend the locking pin leg around the washer groove.

E. Complete the Installation

(1) Remove protection cover from exhaust diffuser vanes.

CR 34021/00D

REHEAT SPRAY RING
CONNECTING LINK

PIN

WELDED SPACING WASHER

DIRECTION OF
PIN INSERTION

GROOVED WASHER

LOCKING WIRE PIN

REHEAT SPRAY RING
CONNECTING LINK

FLAME HOLDER

DIRECTION OF
PIN INSERTION

LIGHT-UP FUEL TUBE LOCATIONS

FUEL TUBE OF SPRAY RING

VIEW LOOKING FORWARD

CMR 73 12 06 4 EAMO

R Flame Holder - Direction of Pin Insertion
Figure 405

(2) Remove servicing equipment installed in the jet pipe for access complying fully with the procedure detailed in 71-00-00, Servicing.

(3) Remove safety clips and reset LP fuel shut-off valve circuit breakers (Ref. Table 401).

REHEAT INJECTION SYSTEM - ADJUSTMENT/TEST

1. Pressure Test and Leak Check the Reheat Injection System

A. General.

This procedure is complementary to the Removal/ Installation of the reheat injection system and details the procedure for leak checks by application of a static pressure using a pressure test and inhibiting ring (PTIR). The reheat fuel injection system downstream of the reheat controller can only be leak checked with a PTIR or during an engine run.

B. Tools and Equipment.

Pressure test and inhibiting rig (PTIR) PE.17988

Pressure test equipment items (contained in adapter set
R PE.29964) are required as follows:

Adapter (Engine No.1 or 3)... 9970-531-043

Adapter (Engine No.2 or 4)... 9970-521-075

Blank, for purge valve air/fuel spill outlet tube connection ... ... -

C. Install Pressure Test Equipment

(1) Ensure that a wax plug is installed in the spray ring elbow (Ref.73-12-06, Removal/Installation).

NOTE: The wax plug is formed to blank-off the spray ring to enable a static pressure to be applied and will be dispersed when the engine is run.

D. Pressure Test Procedure.

(2) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.B, as detailed for the installation and removal of the following items of test equipment and engine components respectively.

(a) 9970-531-043 - adapter (Ref. Fig. 501)(detail C) On engines No.1 or 3 detach purge air tube from reheat purge solenoid valve and assemble adapter in tube end.

R (b) 9970-521-075 - adapter (Ref. Fig. 501)(detail D)
R On engines No.2 or 4 detach and purge air tube
R from reheat purge valve and assemble adapter to
R valve.

R (c) - blank (Ref. Fig. 501)(detail B)
R Assemble blank in purge air/fuel tube.

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with the general procedure and safety precautions.

(b) Connect test rig delivery hose to the test
R adapter and tighten the union nut.

(c) Verify that the weight of the hose is supported and that all connections are secure before commencing test procedure.

R (d) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and re-commence the test procedure.

(2) Carry out a low pressure test.

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

(b) No leaks are acceptable.

R (3) Continue with a medium pressure test.

(a) Operate the test rig and increase the test pressure to 170 psig (1172 kPa).

(b) Apply pressure for at least three minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

R (c) Reduce test pressure to zero and stop pump motor.

R (4) On completion of a pressure test, drain the fuel
R system using the test rig facilities and then uncouple

R the delivery hose.

E. Remove Test Equipment and Install/Connect Engine Components.

(1) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.D, as detailed for the removal and installation of the following items of test equipment and engine components respectively.

(a) 9970-531-043 - adapter. On engines No.1 or 3 remove adapter and connect purge air tube to reheat purge solenoid valve.

(b) 9970-521-075 - adapter. On engines No.2 or 4 remove adapter and connect purge air tube to reheat purge valve.

(c) - blank. Remove blank and connect purge air/fuel tube.

F. Restore Engine to Flight Standard.

(1) Complete the procedure as detailed in 73-12-06, Removal/Installation.

CR 31232/00C

A
C
FORWARD
D
B

WAX PLUG
A
REHEAT FUEL
SPRAY RING

PURGE AIR/FUEL TUBE-
PURGE VALVE TO SPHERICAL
JOINT FLANGE
FROM PURGE
VALVE
BLANK
B

REHEAT PURGE
SOLENOID VALVE
PURGE AIR TUBE-
SOLENOID VALVE
TO PURGE VALVE
ADAPTER
C
INPUT ADAPTER
No. 1 OR 3 ENGINES

PURGE AIR TUBE-
SOLENOID VALVE
TO PURGE VALVE
REHEAT FUEL
CONTROLLER
ADAPTER
REHEAT
PURGE VALVE
D
INPUT ADAPTER
No. 2 OR 4 ENGINES

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R

Installation of Test Equipment and Location
Figure 501

REHEAT INJECTION SYSTEM - INSPECTION/CHECK

1. General (Ref. Fig.601 and 602)

This chapter difines the inspection to be carried out and the acceptance criteria related to damage affecting the reheat in-
R jection system.
R

2. Prepare the Reheat Injection System for Examination

A. Electrically isolate the engine and exhaust assembly services indicated in Table 601 by tripping the circuit breakers affecting engines in the nacelle upon which work is being carried out. Fit the circuit breakers safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No. 1			
REHEAT CONT.	15-216	1K1542	E 9
REHEAT AMP SUP.	14-215	1K1541	C13
REHEAT IGNITION SUP PH A.	14-215	1K1543	B13
REHEAT IGNITION SUP PH C.	14-215	1K1544	F12
ENGINE No. 2			
REHEAT CONT.	15-215	2K1542	D12
REHEAT AMP SUP.	13-215	2K1541	B14
REHEAT IGNITION SUP PH A.	13-215	2K1543	A14
REHEAT IGNITION SUP PH C.	13-215	2K1544	E14
ENGINE No. 3			
REHEAT CONT	15-215	3K1542	D16
REHEAT AMP SUP.	13-216	3K1541	B 5
REHEAT IGNITION SUP PH A.	13-216	3K1543	A 5
REHEAT IGNITION SUP PH C.	13-216	3K1544	F 6
ENGINE No. 4			
REHEAT CONT.	15-216	4K1542	E10
REHEAT AMP SUP.	14-216	4K1541	D 7
REHEAT IGNITION SUP PH A.	14-216	4K1543	A 6
REHEAT IGNITION SUP PH C.	14-216	4K1544	E 7

Circuit Breakers
Table 601

B

A

A

CRACKS UNACCEPTABLE.
RETURN TO MAIN BASE
AUTHORIZED. REHEAT
OPERATION PROHIBITED

MISSING PIN
UNACCEPTABLE.
RETURN TO MAIN BASE
AUTHORIZED IF ONE
OF THE INJECTION SYSTEM
ATTACHMENT PINS IS MISSING

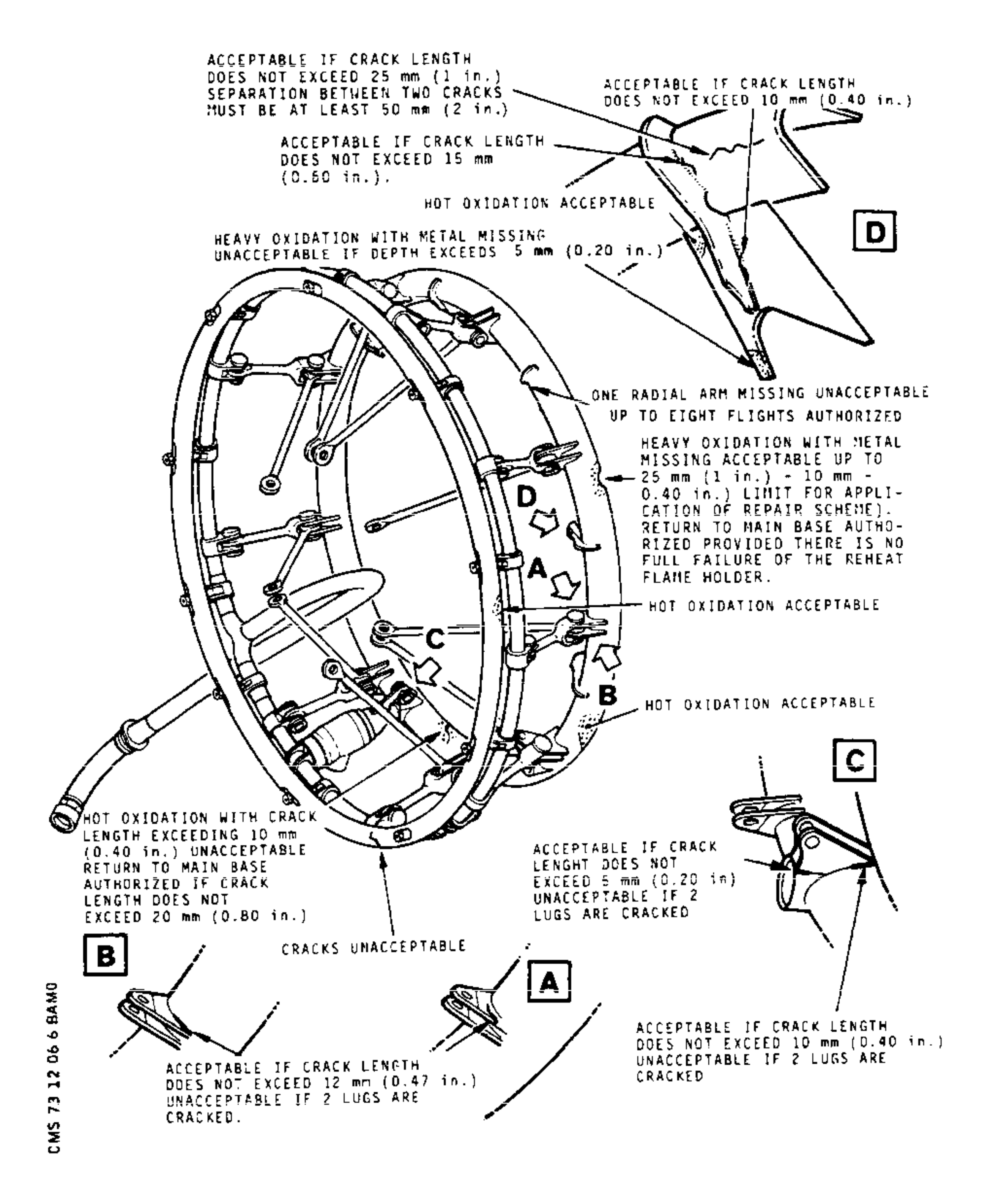
FAILURE OF LINK UNACCEPTABLE.
RETURN TO MAIN BASE AUTHORIZED
IF ONE OF THE REHEAT INJECTION
SYSTEM LINKS IS BROKEN

B

CRACKS UNACCEPTABLE.
RETURN TO MAIN BASE
AUTHORIZED. REHEAT OPERATION PROHIBITED

GMS 73 12 06 6 AAMO

Inspection of Injection System Spray
Ring Acceptance Criteria
Figure 601



Inspection of Injection System Flame-Holder and Anvil Acceptance Criteria
Figure 602

R

WARNING: MAKE SURE THAT NO SOURCE OF COMPRESSED AIR IS CONNECTED TO THE GROUND CONNECTIONS OF THE TWIN SECONDARY NOZZLE.

B. Carry out the safety precautions and work sequences required for access to the jet-pipe as detailed in 71-00-00, Servicing.

WARNING: HIGH ENERGY IGNITION EQUIPMENT CAN BE LETHAL. COMPLY WITH THE SAFETY PRECAUTIONS DETAILED IN CHAPTER 12.

C. Display a suitable placard on the engine starting panel indicating that personnel are working on the engines and in the twin secondary nozzle area.

3. Examine the Reheat Injection System

A. Visual Inspection

(1) Enter the rehat jet-pipe and inspect the injection system for damage.

(2) Inspect the flame-holder for damage. Hot oxidation marks on the "support wings" trailing edges are acceptable.

NOTE: If cracks are suspected, carry out a DYE PENETRANT check. Refer to chapter 70.

(3) Inspect the anvil for damage. Hot oxidation marks are acceptable. Cracking not acceptable.

NOTE: If cracks are suspected, carry out a DYE PENETRANT check - Refer to chapter 70.

(4) Inspect the spray ring for damage. De-brazing of bushes is unacceptable. Cracks not acceptable.

NOTE: If cracks are suspected, carry out a DYE PENETRANT check - Refer to chapter 70.

CAUTION: IF CRACKS ARE FOUND - REHEAT OPERATION IS PROHIBITED.

(5) Inspect the links and their attachment to the reheat injection system and the engine exhaust bullet. One missing pin or one brooken link is acceptable for return to main base only.

(6) Carefully inspect the reheat injection system inner elbow for damage.

NOTE: If cracks are suspected, carry out a DYE PENETRANT check. Refer to chapter 70.

CAUTION: IF CRACKS ARE FOUND REHEAT OPERATION IS PROHIBITED.

4. Acceptance Criteria (Ref. Fig.601 and 602)

A. Compare injection system damage with the criteria specified on the appropriate series of illustration sheets.

B. If damage exceeds the specified dimensional limits, reject the component for rectification.

FUEL PRESSURE ATOMIZING (PILOT) NOZZLE ASSEMBLY REMOVAL/INSTALLATION

1. General

The standards of pilot nozzle assemblies to pre and S.B.OL.
593-73-12 and pre and S.B.OL.593-73-13 are all installed
similarly. A retaining clip is introduced by S.B.OL.593-74-1
R and may be deleted by S.B. OL.593-73-8527-68 while gaskets
R for mating faces are required by S.B.OL.593-72-58 and either,
both or neither may be used. Where the procedures are
affected by the service bulletin standard, the differences
are indicated.

NOTE: The retaining clip introduced by S.B. 72-58 is a substitute for the clip installed under S.B. 74-1.

2. Fuel Pressure Atomizing Nozzle Assemblies(Ref. Fig. 401)

A. Prepare to Remove Nozzle Assembly

(1) Open engine bay rear lower door (Ref. 71-00-00, Servicing).

B. Remove Nozzle Assembly

(1) Unscrew union nut securing fuel tube to nozzle.

(2) Remove bolts securing nozzle to combustion chamber outer case.

(3) Withdraw the nozzle assembly from its location.

(a) Disengage the fuel tube union from the nozzle connection.

(b) Withdraw the nozzle together with the adjusting washer and, dependant on the service bulletin standard, the gaskets from between each of the mating faces.

R (c) Ensure that the fuel transfer tube of a pre
R S.B. OL.593-73-13 standard nozzle assembly is
R not dislodged from the nozzle bore and sep-
R arate the nozzle from the gaskets, adjusting
R washer and retaining clip. The retaining
R clip will remain loose on the igniter plug
R assembly if engine is of this service
R bulletin standard.

NOTE: The nozzle body spinner and transfer tube are

CR 31112/00E

FORWARD

A

COMBUSTION CHAMBER OUTER CASE

IGNITER PLUG

GASKET (SB. OL.72-58)

RETAINING CLIP (SB. OL. 74-1/PRE SB. 73-68)

GASKET (SB. OL.72-58)

ADJUSTING WASHER

GASKET (SB. OL.72-58)

ATOMIZING NOZZLE

A

ADJUSTING WASHER AND GASKET INSTALLATION (SB. OL. 72-58 AND PRE SB. OL. 74-1 OR SB. OL. 73-68)

FUEL TUBE

CMR 73 12 07 4 AAMO

VIEW SHOWING WIRE LOCKING ARRANGEMENT

Fuel Pressure Atomizing (Pilot) Nozzle Assembly
and Location Detail
Figure 401

R

calibrated as a matched set. When removed from the engine the transfer tube of a pre S.B.OL. 593-73-13 standard nozzle assembly will not be dislodged if nozzle is kept upright with its fuel inlet at the top.

(d) Retain adjusting washer identified with its location.

(e) On engines to pre S.B.OL.593-72-58 standard, remove any deposits of jointing compound from abutment surfaces (Ref.70-00-08).

C. Install Nozzle Assembly.

(1) Ascertain the service bulletin demanded for the engine. Both nozzle assemblies must be installed to identical service bulletin standards.

(2) Collect new gaskets preparatory for installation except for the pre S.B.OL.593-72-58 standard engines where no gaskets are installed.

(a) On pre S.B.OL.593-74-1, two gaskets are required for use with adjusting washer.

(b) On S.B.OL.593-74-1/pre S.B.OL.593-73-8527-68, three gaskets are required for use with adjusting washer and retaining clip.

(3) Establish and produce the adjusting washer/ pre S.B.OL.593-73-8527-68 thickness necessary to obtain the correct nozzle penetration on assembly as detailed in 73-12-07, Adjustment/Test. Identify the nozzle and selected items with the specific CCOC location.

<u>NOTE:</u> Use the adjusting washer identified with the location if within a suitable size range.

R <u>CAUTION:</u> IT IS ESSENTIAL THAT LUBRICANT 'C' IS USED
R ON THE APPLICABLE BOLTS/NUTS DURING
R ASSEMBLY. (REF. SB.OL.593-72-9044-436).

(4) Apply lubricant C (Ref.70-00-01, Servicing and Storage Materials) to nozzle attachment bolts.

(5) On pre S.B.OL.593-72-58 standard engines, assemble and secure nozzle assembly, together with the selected adjusting washer/retaining clip combination, to the same CCOC location that was used to calculate its penetration (Ref. para.(3)).

(a) Apply jointing compound A to the cleaned mating faces of the items for assembly (Ref.70-00-08).

(b) Assemble the specified adjusting washer to the nozzle and engage it with its aperture in the CCOC. On engines to S.B.OL.593-74-1/pre S.B.OL.593-73-8527-68 standard, engage nozzle with hole of retaining clip during insertion.

(c) Align attachment holes and retain assembly in position with bolts lightly tightened.

<u>NOTE:</u> Holes are offset to ensure correct nozzle outlet orientation.

(d) Torque-tighten bolts to 100 lbf in (11,5 Nm) using the procedure specified for jointing compound application (Ref.70-00-08).

(6) On S.B.OL.593-72-58 standard engines, assemble and secure nozzle assembly, together with the selected adjusting washer/retaining clip/gasket combinations, to the same CCOC location that was used to calculate its penetration (Ref.para.(3)).

(a) With a single gasket interposed between each pair of mating faces, assemble the nozzle and selected items to the CCOC location and align attachment holes.

<u>NOTE:</u> Holes are offset to ensure correct nozzle outlet orientation.

(b) Retain nozzle and associated items in position with three bolts lightly tightened.

(c) Torque-tighten bolts to 100 lbf in (11,5 Nm).

(7) Engage fuel tube connection with nozzle.

(8) Apply lubrication A to fuel tube union connection. Torque-tighten nut to between 190 and 210 lbf in (21,5 and 23,7 Nm).

(9) Wire-lock union nut to HT ignition lead nut and wire-lock attachment bolts.

D. Complete the Installation.

(1) Close engine bay rear lower door (Ref.71-00-00, Servicing).

(2) Carry out checks specified for fuel pressure atomizing (pilot) nozzle assembly (Ref. 71-00-00, Adjustment/Test, Table 501).

FUEL PRESSURE ATOMIZING (PILOT) NOZZLE ASSEMBLY - ADJUSTMENT/TEST

1. General

Pilot nozzle assembly penetration in the combustion chamber must be within specified limits. The correct penetration is normally established by use of an adjusting washer but failure to obtain sufficient penetration when a retaining clip (S.B.OL.593-74-1) is installed will necessitate compliance with S.B.OL.593-73-8527-68, removal of retaining clip and associated gasket. This chapter gives the method whereby the adjusting washer thickness necessary to provide the correct penetration can be ascertained.

R

2. Tools and Equipment

Hooked depth gauge S3S.15001000

3. Nozzle Assembly Penetration Adjustment

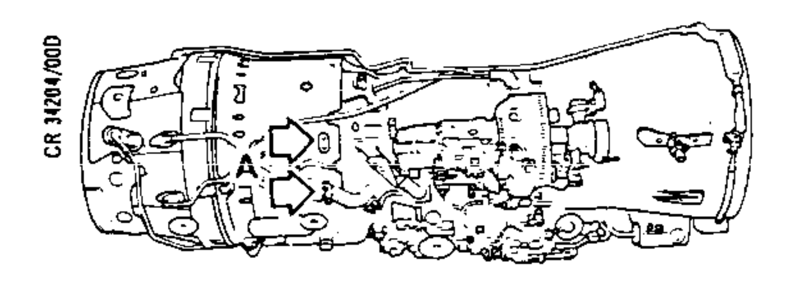
A. Establish Penetration/Adjusting Washer Thickness (Ref. Fig.501).

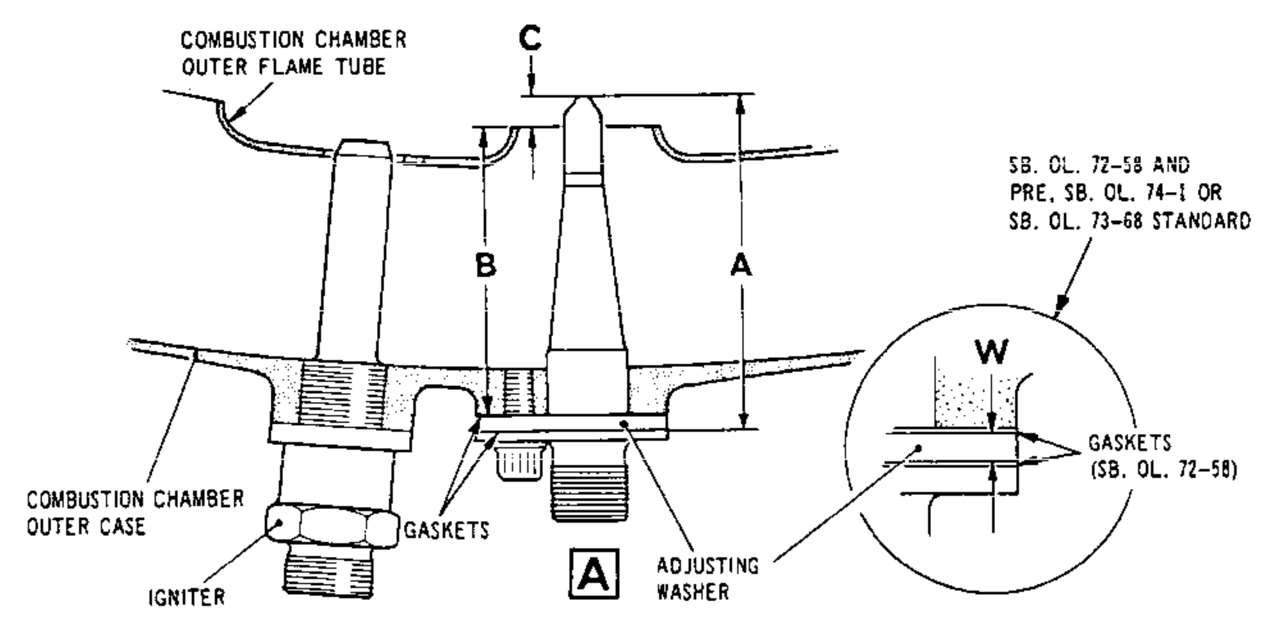
(1) Measure distance from nozzle mounting flange abutment face to tip of nozzle and note as dimension A.

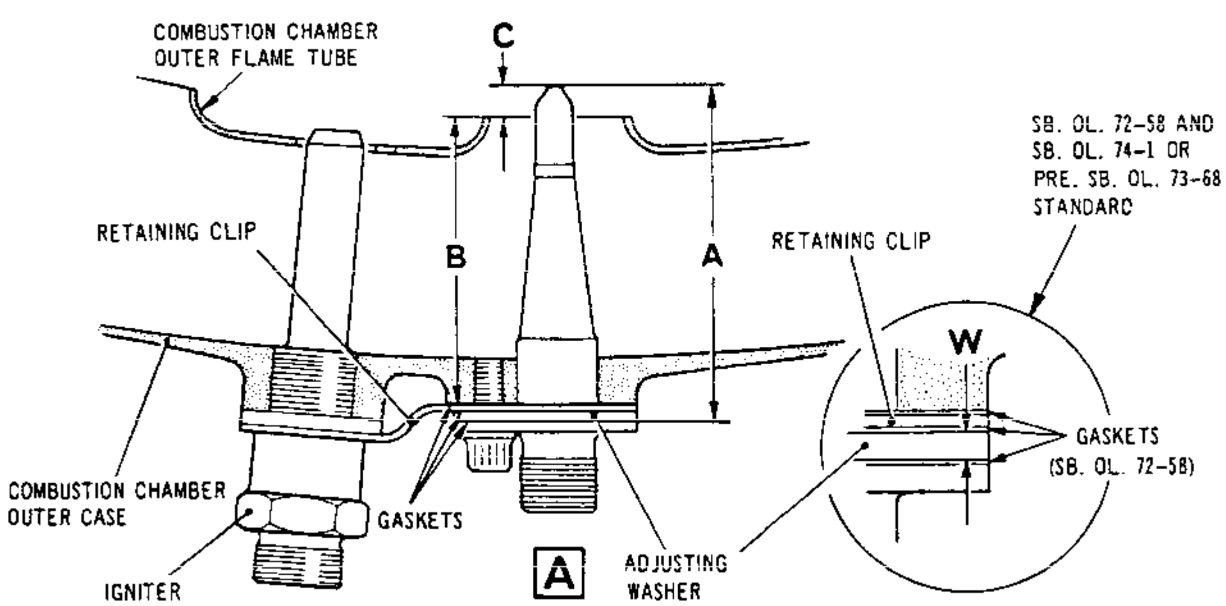
NOTE: The centre of the fuel outlet orifice is the effective nozzle penetration but measurement of length to the tip of the nozzle permits direct calculation in determining adjusting washer thickness.

(2) Use hooked depth gauge and measure the distance between mounting boss abutment face on CCOC and inner edge of combustion chamber outer flame tube and note as dimension B.

R (3) On engines to S.B.OL.593-74-1 standard, measure the
R thickness of the retaining clip (73-12-07/1-40), and
R record as dimension T.







Fuel Pressure Atomizing (Pilot) Nozzle Assembly
Penetration Dimensions
Figure 501

R (4) On engines to S.B.OL.593-72-58 standard, measure the thickness of each new gasket (73-12-07/1-25) separately on the undeformed area, add the measurements together and record as dimension K.

R (5) Pilot nozzle penetration (dimension C) is as follows:

R (a) On engines pre S.B.OL.593-73-12 standard,

R C = 0.216/0.140 in (5,49/3,56 mm).

R (b) On engines to S.B.OL.593-73-12 standard,

R C = 0.250/0.140 in (6,35/3,56 mm).

R (6) Calculate adjusting washer thickness W as follows:

R $W = A - B - T - K - C$

R Ignore dimensions T and K if not applicable.

R NOTE: It is recommended that the maximum value of dimension C should be aimed for (Ref. para.(5)) by varying W to suit.

R (7) If dimension W is a very small or negative value, carry out one of the following alternatives:

R (a) Incorporate S.B.OL.593-73-8527-68, deleting the clip and its associated gasket. Re-calculate dimension K (Ref.para.(4)), and delete dimension T in the formula in para.(6). Ensure that the necessary documentation is completed.

R (b) Delete the adjusting washer and its gasket. This is acceptable provided that nozzle penetration is within the limits stated in paragraph (5).

R NOTE: Do not use more than one gasket between any two mating faces.

R (8) Machine the adjusting washer to the thickness recorded as dimension W within the limit of plus 0.000, minus 0.002 in. (plus 0,00 minus 0,05 mm).

R (9) Identify the nozzle assembly and assembly items used in the calculations with the specific CCOC location.

R (10) Ensure that both nozzle assembly locations will be to the same service bulletin standard after installation.

R (ii) Calculate adjusting washer thickness W and
R record value obtained.

R W = S-T

R. (d) On engines to S.B.OL.593-72-58 and S.B.OL.593
R S.B.-74-1/pre OL.593-73-8527-68 (with gaskets and
R retaining clip interposed).

R (i) Use new gaskets and measure each separately
R on the flat undeformed area.

R (ii) Measure retaining clip thickness.

R (iii) Add the measurements obtained and record as
R dimension T.

R (iv) Calculate adjusting washer thickness W and
R record value obtained.

R W = S-T

R If the calculated dimension W is
R unobtainable i.e., a negative value, one of
R the procedures in paragraph (v) and (vi)
R must be used.

R (v) When standard procedure is invalid,
R calculate the nozzle penetration obtained
R if the adjusting washer and its associated
R gasket are omitted.

R T = thickness of retaining clip and two
R gaskets

R Penetration is acceptable if:

R S-T = ± 0.020 in. (0,508 mm)

R If result is unacceptable, use the
R procedure given in paragraph (vi)
R instead.

R (vi) If the preceding procedures fail to give
R an acceptable nozzle penetration, refer to
R S.B.OL.593-73-8527-68 and delete the
R retaining clip and associated gasket and
R then measure and calculate the adjusting
R washer thickness using the standard
R procedure given in paragraph (c).

R (e) Machine the adjusting washer to the thickness
R recorded as dimension W within the limit of
R ± 0.020 in. (0,508 mm).

R (f) Identify the nozzle assembly and assembly items
R used in the calculations with the specific CCOC
R location.

R (g) Ensure that both nozzle assembly locations will
R be to the same service bulletin standard after
R installation.

FUEL TUBES - DESCRIPTION AND OPERATION

1. General

Distribution of fuel between components is made through rigid tubes in the direction of the arrows as shown in the illustration (Ref. Fig. 001). The tubes and their connections are identified by letters as shown in the illustrations (Ref. Fig.001 and 002). Rigid and flexible tubes are also provided for fuel drainage (Ref.71-73-00).

The aircraft fuel system connects to the engine system at the main fuel inlet elbow and at the recirculation valve. Both union nut and bolted flange type connections are used for the tube connections, and clamp assemblies provide for tube support. A seal plate, with primary and secondary static seals, is used at each flanged connection to form a double seal. The space between the seals connects to the seal failure drains system as described in 71-73-00. Servicing points are incorporated in some tubes and are blanked by tube closure ferrules.

2. Fuel Tubes, First Stage Pump to Second Stage Pump (Tubes A.B.)

Two tubes, in three sections with bolted flange type connections, connect the first stage pump to the second stage pump.

The tube from the outlet at the fuel heater/filter to the oil cooler fuel inlet is in two sections. At the junction of the two sections, one flange incorporates a servicing point for draining. The tube connecting the oil cooler fuel outlet to the second stage pump inlet terminates in an elbow fitment at the second stage pump inlet elbow that has two union connections, one for the fuel supply tube to the electric starter pump (Tube J) and one for the fuel return tube to recirculation valve (Tube P).

3. Fuel Tubes, FCU Supply to Fuel Manifold (Tubes C.D.E.)

Three tubes connect the FCU to the manifolds. The tube connecting the FCU to the engine flowmeter is bolted to a flanged adapter assembly at the FCU fuel outlet port and to the inlet flange of the flowmeter. The tube flange at the flowmeter has a servicing point and a servo spill tube connection. Two tubes connect the distribution and dump valve outlet ports to the union connections of the upper and lower manifolds. Service points on the tube flanged connections enable the distribution and dump valve to be blanked for pressure test.

CR 31307/00B

RECIRCULATION VALVE
AIR BLEED VALVE
EJECTOR PUMP
FIRST STAGE PUMP
ELBOW FITMENT
HEATER AND FILTER
OIL COOLER
INLET ELBOW
ELECTRIC STARTER PUMP
FLOWMETER
REHEAT FUEL CONTROLLER
CONNECTING BLOCK
REHEAT INJECTION SYSTEM

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TUBE IDENTIFICATION LETTER	TUBE DESCRIPTION
A B	TUBES, FIRST STAGE PUMP TO SECOND STAGE PUMP
C D E	TUBES, FCU SUPPLY TO FUEL MANIFOLD
G H	TUBES, FIRST STAGE PUMP SUPPLY TO REHEAT INJECTION SYSTEM
J	TUBE, SECOND STAGE PUMP INLET ELBOW TO STARTER PUMP
K	TUBE, STARTER PUMP SUPPLY TO FCU
L M	TUBES, STARTER PUMP SUPPLY TO PILOT ATOMIZING NOZZLES

Diagrammatic Arrangement of Fuel System and Tube Identification (Sheet 1 of 2)
Figure 001

R

CR 31388/00B

SERVICING POINT
UNION CONNECTION
FLANGE CONNECTION

B
SECOND STAGE PUMP
FCU
R
S
C
ADAPTER
FLOWMETER
DISTRIBUTION AND DUMP VALVE
D
E
MANIFOLD AND FUEL ATOMIZING NOZZLES
K
Q
N
L
L
M
PILOT ATOMIZING NOZZLES
N
T
DRAINS TANK

CMR 73 13 00 0 AAMB

TUBE IDENTIFICATION LETTER	TUBE DESCRIPTION
N	TUBE, REHEAT CONTROLLER AND FCU SPILL TO FIRST STAGE PUMP INLET ELBOW
P	TUBE, SECOND STAGE PUMP RETURN TO RECIRCULATION VALVE
Q R S	TUBES, DISTRIBUTION AND DUMP VALVE (SERVO AND SERVO SPILL)
T U	TUBES, DRAINS TANK RETURN TO FIRST STAGE PUMP RECIRCULATION VALVE
V	TUBE, OIL COOLER TO AIR BLEED VALVE
W	TUBE, HEATER AND FILTER OUTLET TO REHEAT FUEL CONTROLLER (SERVO SUPPLY)

Diagrammatic Arrangement of Fuel System and
Tube Identification (Sheet 2 of 2)
Figure 001

R

4. Fuel Tubes, First Stage Pump Supply to Reheat Injection System (Tubes G.H.)

Two tubes connect the first stage pump to the reheat spray ring. One tube, with flanged connections, connects the first stage pump to the reheat flowmeter, and provides for a servicing point and an integral fuel filter. The cone type filter assembly is retained in the tube housing by a blanking plate and a seal plate.

A blanked connection on the blanking plate permits draining at this point. The rear tube is from the reheat fuel controller to the reheat spray ring and is connected by union nuts. A blanked connection in mid-position on the tube provides an input connection for pressure testing.

R 5. Fuel Tubes, Second Stage Pump Inlet Elbow to Pilot Atomizing
R Nozzles (Tubes J.L.M.)

Six sections of tube connect between the fuel tube elbow (Tube B) at the second stage pump inlet elbow to the pilot
R atomizing nozzles. The first section of tube is from the
R connection on the oil cooler to second stage pump tube
R elbow to the starter pump inlet connection and has a union
R nut connection at each end. A tube in two sections,
R attached to a starter pump outlet by a union nut, connects
R to the dump valve casing of the distribution and dump
R valve by a bolted flange. The next section of tube
R connects by a bolted flange the pilot nozzles fuel outlet
R port on the dump valve casing to the tube junction bolted to
R a bracket. The junction provides a double connection for
R the two sections of tube connected between the junction and
R the pilot sprayers. Union nut connections are used for the
R ends of both tubes.

6. Fuel Tubes, Starter Pump Supply to FCU (Tube K.)

A tube, in two sections with union nut connections, connects from a starter pump outlet to the FCU. An elbow adapter and a seal plate, bolted to the starter pump, provides a connection for the tube and incorporates a servicing point that can be used for draining fuel. A housing containing a filter, bolted to the FCU, provides for the tube connection at the FCU. Seal plates, used at the end of the housing, effect the sealing with the FCU as shown.

7. Fuel Tubes, Reheat Controller and FCU Spill to First Stage Pump Inlet Elbow (Tube N.)

A five section tube, with union connections at tube junctions, connects the reheat fuel controller and FCU to the first

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stage pump. The tube connections at the components are of the bolted flange type with seal plates. From the reheat fuel controller two sections of tube connect, via a block connection, to the rear connection of the multi-connection centre tube assembly. Flanged connections on the double branch of the tube assembly bolt with seal plates to the FCU spill connection and low pressure sensing valve connection. From the main outlet connection of the multi-connection centre tube assembly, two sections of tube connect with a flanged connection to the inlet elbow of the first stage pump.

8. Fuel Tube, Second Stage Pump Inlet Elbow Return to Recirculation Valve (Tube P.)

The tube from the second stage pump inlet to the recirculating valve connects to the union connection provided at the tube elbow, oil cooler to second stage pump (Tube B), and to the flange connection at the recirculation valve.

9. Fuel Tubes, Distribution and Dump Valve (Servo and Servo Spill) (Tubes Q.R.S.)

Three small bore tubes of four sections connect the FCU, flow-meter and distribution and dump valve. A servo tube, with flanged ends, connects the rear face of the FCU to the dump valve at the distribution valve. The flange connection at the dump valve incorporates a servicing point for the installation of an adapter for pressure test input. A servo spill tube, in two sections, connects the rear face of the FCU to the rear face of the distribution valve. Bolted flanges connect the tube ends at the components and a union connection forms the tube junction. The servo spill tube connecting the distribution valve to the flowmeter has a bolted flange connection at the distribution valve rear face and a union nut connection at the FCU to flowmeter tube.

10. Fuel Tubes, Drains Return to First Stage Pump/Recirculation Valve (Tubes T.U.)

The tube from the drains tank to the recirculation valve is in seven sections with union nut connections. Five sections of tube connect the drains tank to the ejector pump inlet at first stage pump, and two tube sections connect the ejector pump outlet to the recirculation valve. The section of tube, ejector pump to recirculation valve, has a servicing point for blanking purposes during pressure test.

11. Fuel Tube connecting Cooler to Air Bleed Valve (Tube V.)

A tube, in two sections with union nut connections, connects from the top of the oil cooler to the air bleed valve. The

CR 31304/00A

LP SENSING VALVE CONNECTION
SPILL CONNECTION
TUBE N MULTI-CONNECTION CENTRE ASSEMBLY
A
TUBE K HOUSING AND FILTER ASSEMBLY
B
C
AIR BLEED VALVE ASSEMBLY
VALVE STEM
SEAL
DUST CAP

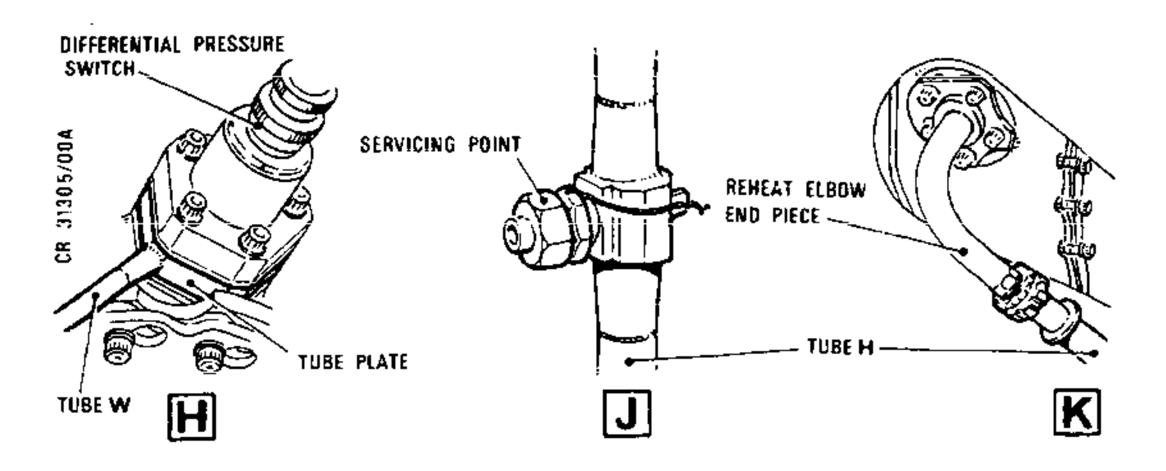
CMR 73 13 00 0 BAMA

RECIRCULATING VALVE
INLET ELBOW
FIRST STAGE PUMP
FCU
OIL COOLER
TUBE V
TUBE K
DISTRIBUTION BLOCK
TUBE N
TUBE B
TUBE J
TUBE P
TUBE A
SECOND STAGE PUMP INLET ELBOW
TUBE N
STARTING PUMP
A
B
C
D
E
F

SEAL DRAINS CONNECTIONS
F
SERVICING POINT
TUBE A JUNCTION POINT
TUBE P
TUBE B ELBOW FITMENT
E
TUBE J
UNION NUT
TUBE CLOSURE FERRULE
TUBE N CONNECTION BLOCK
REHEAT CONTROL UNIT
D

S/s

Fuel Tube Installation (Sheet 1 of 3)
Figure 002



TUBE U
TUBE W
TUBE H
H
L
K
J
TUBE T
TUBE G

CMR 73 13 00 0 BAMB
SERVICING POINT
SEAL DRAIN SYSTEM CONNECTION
L
INLET
OUTLET

Fuel Tube Installation (Sheet 2 of 3)
Figure 002

CR 31306/00A

TUBE S
TUBE D
TUBE R
TUBE C
SERVICING POINT
TUBE E
N
P
Q
DISTRIBUTION BLOCK REAR FACE
FCU
TUBE Q
S
TUBE D
N
Q
P
TUBE R
R
TUBE E
TUBE M
TUBE C
FLOWMETER
FORWARD
STARTING PUMP
TUBE L
TUBE V
TUBE L
TUBE M
TUBE K
TUBE Q
R
TUBE R
S
SERVICING POINT
FCU REAR FACE
DISTRIBUTION BLOCK
TOP FACE

CMR 73 13 00 0 BAMC

Fuel Tube Installation (Sheet 3 of 3)
Figure 002

air bleed valve, integral with the tube, is bolted to a bracket mounted on the distribution and dump valve. The threaded valve assembly is closed when the spherical head of the valve seats against the face of the valve body. The valve stem provides for the attachment of a bleed tool and a dust cap and seal encloses the assembly.

12. Fuel Tube, Heater/Filter Outlet to Reheat Fuel Controller (Servo Supply) (Tube W.)

This tube is in three sections and connects the fuel heater/filter to the reheat controller. A tube plate and union nuts provide for the tube connections. The plate is retained, with a seal plate on each side, between the lower differential pressure switch and its mounting face on the heater and filter.

13. Operation of Main Fuel Supply Tubes (Tubes A.B.C.D.E.)

From the heater and filter, first stage pump output passes through the tubes to the second stage pump inlet, via the oil cooler, and passes through the pump and FCU. The tube from the FCU directs the fuel to the engine flowmeter, the fuel passing through the flowmeter to the distribution block. From outlets at the rear face of the distribution and dump valve the two FCU supply to manifold tubes direct the fuel to the upper and lower manifold connections.

14. Operation of Reheat Fuel Supply Tubes (Tubes G.H.)

Fuel is directed from the first stage pump reheat fuel oulet by the first stage pump to reheat spray ring tubes through a filter assembly to the reheat flowmeter. The fuel passes internally through the flowmeter, reheat controller and purge valve, and is then directed by the tube to the spray ring.

15. Operation of Starting Fuel Supply Tubes (Tubes J.K.L.M.)

Tube J conveys fuel from the tube elbow at the second stage pump inlet connection to the starter pump during the starting cycle. Fuel from the starter pump is delivered to two outlets. From one outlet the main starting flow tubes deliver the fuel, via a filter, to the FCU and the second outlet
R delivers fuel through the pilot atomizing nozzle tubes to
R the pilot atomizing nozzles via the distribution and dump valve case.

16. Operation of Fuel Return Tubes (Tubes N.P.T.U.)

The reheat and FCU to first stage pump fuel tube directs fuel spill from the FCU, FCU low pressure sensing valve, and the reheat controller to the inlet elbow at the first stage pump.

The second stage pump return to recirculation valve tube directs fuel from the main engine fuel supply, oil cooler to second stage pump tube, to the recirculation valve when the valve is opened.

The drains return to first stage pump/recirculation valve tube, directs fuel drawn from the drains tank by the action of the ejector pump to the inlet connection at the ejector pump. Fuel from the ejector pump outlet is directed by the tube to the fuel return side of the recirculation valve.

17. Operation of Servo and Servo/Spill Tubes (Tubes Q.R.S.W.)

The servo tube from the FCU to the distribution and dump valve casing transmits servo pressure flow to close the dump valve. The servo spill tube from the rear face of the FCU directs the fuel to the servo spill inlet on the rear face of the distribution and dump valve. The tube from the distribution valve rear face returns servo spill fuel to the main fuel supply, FCU to flowmeter tube.

The fuel tube, filter and heater outlet to reheat controller, Directs some filtered first stage pump fuel to the reheat controller at shut-off valve servo pressure.

18. Operation of Servicing Points

Bleeding, pressure testing and draining the fuel system is carried out by removing the tube closure ferrules from the servicing points and connecting the appropriate servicing equipment.

The tube connecting the oil cooler to the air bleed valve connects the top of the cooler, the highest point in the fuel system, to the air bleed valve. During a bleeding operation, fluid will flow down the tube, over the valve head and through the valve stem when the valve is unscrewed a few turns, and will carry away trapped air.

For pressure testing the tube connections and components of the fuel system, blanking units and pressure test input adapters are installed in the servicing points provided. Test pressure is applied at the input points and the bleed valve can be used to remove air. The applied pressure will then disclose any leak. The pressure input points are the fuel inlet elbow (Ref.73-12-03), the servo tube, FCU to distribution and dump valve casing, and the reheat controller to spray ring tube. Fuel tube servicing points for blanking are on the tube ejector pump outlet to recirculation valve and the two distribution valve to manifold tube connections.

Servicing points for draining the fuel system are located at the blanking plate locating the filter assembly in the first stage pump to reheat flowmeter tube. The tube junction at the tube heater/filter to oil cooler, the flowmeter connection on the tube FCU throttle actuator to flowmeter, and at the elbow adapter on the starter pump to FCU tube.

TUBES - FIRST STAGE PUMP TO SECOND STAGE PUMP - REMOVAL/INSTALLATION

1. General

The fuel tubes, which commence at the filter outlet, connect between the first stage pump, via the fuel heater and filter, to the second stage pump and are in three sections, filter outlet to tube junction, tube junction to oil cooler fuel inlet, and oil cooler fuel outlet to second stage pump. The removal/installation procedure for the first section is given in paragraph 3.

2. Tools and Equipment

Air bleed tube PE.22898

Drain tube PE.34076

Circuit breaker safety clip ... ... -

3. Tube - Filter Outlet to Tube Junction (Ref. Fig. 401)

A. Prepare to Remove Tube.

(1) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.1			
R	LP VALVE SUP 1	15-216	1Q1	C1
R	LP VALVE SUP 2	16-215	1Q2	-
	Engine No.2			
R	LP VALVE SUP 1	15-216	2Q1	F2
R	LP VALVE SUP 2	15-215	2Q2	C19

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.3			
R	LP VALVE SUP 1	15-216	3Q1	F1
R	LP VALVE SUP 2	15-215	3Q2	C20
	Engine No.4			
R	LP VALVE SUP 1	15-216	4Q1	C2
R	LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 401 (Concluded)

(4) Drain engine fuel system.

(a) Utilize the air bleed valve near the fuel distribution and dump valve and fuel inlet elbow drain valve and drain the system.

(b) When fuel drain ceases, remove the drain tool and close the bleed valve leaving the bleed tube in position ready for the pressure test sequence.

B. Remove Tube.

(1) Remove seal failure drains system tubes fluid passage bolt from tube flange.

(2) Remove bolts securing tube flange to filter outlet.

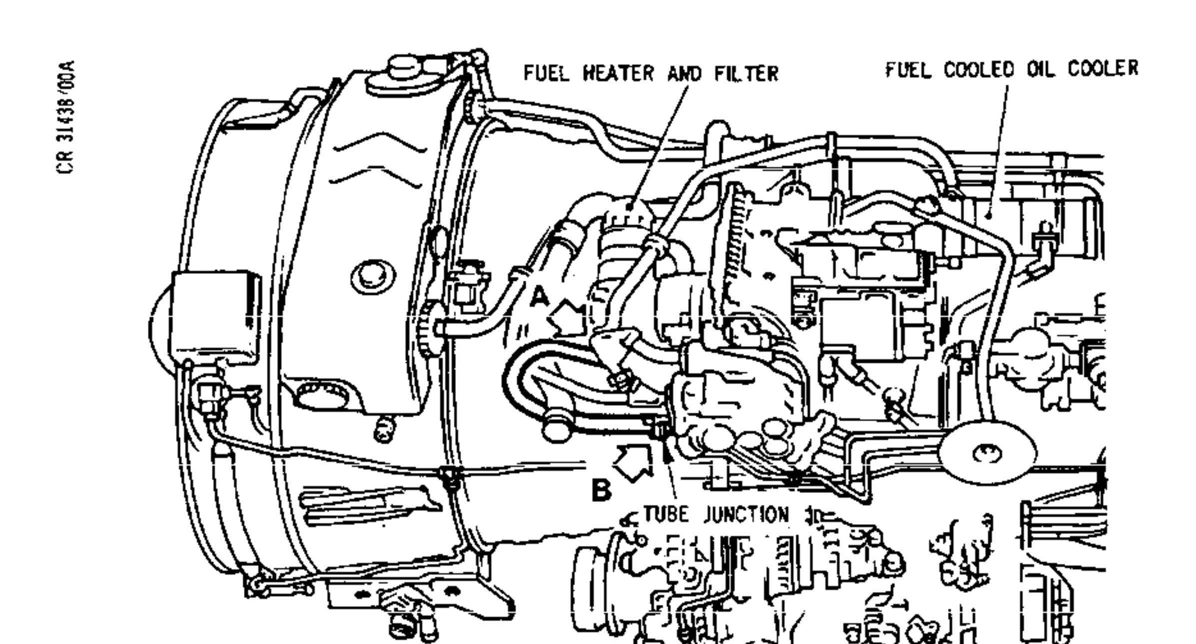
(3) Remove bolt, flat washer and nut securing fuel tube clamp assembly to bracket on fuel tube junction.

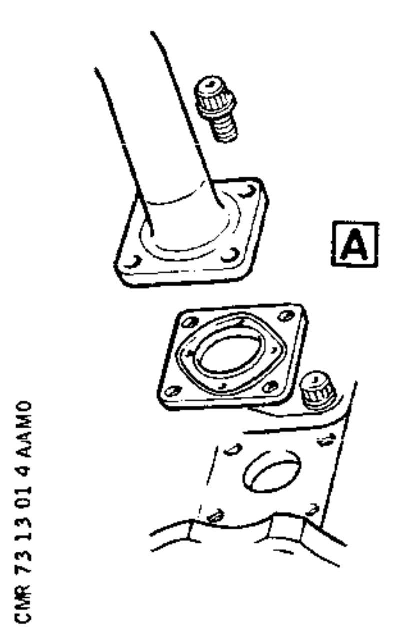
(4) Remove four bolts and nuts securing tube flanges and bracket. Slide bracket and bearing vent tube clamp forward to give removal clearance for tube flange. Withdraw tube from engine.

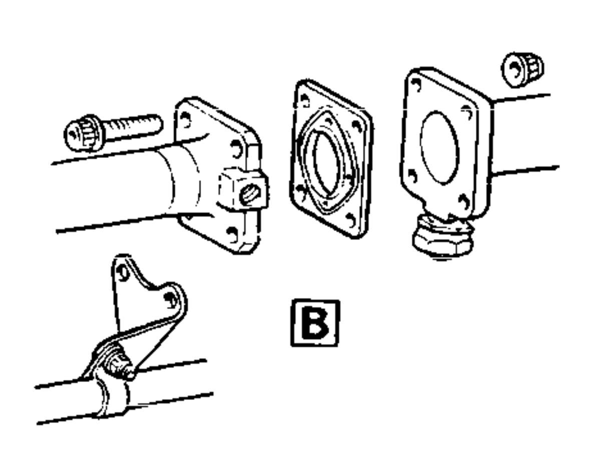
C. Install Tube.

(1) Apply lubricant B (Ref.70-00-01, Servicing and Storage Materials) to tube flange attachment items.

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R

Filter Outlet to Tube Junction
Figure 401

(2) Support tube in position, interpose a serviceable seal plate (Ref.70-00-03, Sealing Devices) between the mating faces of the tube flange and heater and filter, then secure tube to outlet with four bolts lightly tightened.

(3) Ensure that tube junction flanges are in alignment and insert a new seal plate. Position tube support bracket to junction flange, then assemble four bolts and nuts to secure bracket and junction.

(4) Torque-tighten junction flange bolts and nuts and tube flange to filter bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(5) Apply lubricant B to reheat fuel tube clamp attachment items, secure with bolt, flat washer and nut torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

WARNING: KERIMID 601 RESIN IS USED IN THE LAYERS OF FIRE RESISTANT WRAPPING ON FUEL TUBES TO S.B.OL.593-73-8789-88 STANDARD. ALTHOUGH HARMLESS IN ITS CURED STATE ON FINISHED TUBES, ITS VAPOUR IS POTENTIALLY CARCINOGENIC IF USED AS A TOUCH-UP FOLLOWING LOCAL DRESSING OF THE WRAPPING TO OBTAIN CORRECT CLEARANCES.

R WHERE POST SB.OL.593-73-8789-88, PRE SB.OL.
R 73-9057-102 STANDARD TUBES ARE LOCALLY
R DRESSED, EXISTING STOCKS OF KERIMID 601
R CAN BE USED FOR LOCAL TOUCH-UP PROVIDED
R THE APPROPRIATE SAFETY MEASURES AND
R PRECAUTIONS ARE TAKEN. IF NO STOCKS OF
R KERIMID 601 EXIST, ARALOK 210 MAY BE USED
R FOR LOCAL TOUCH-UP WITH NO SAFETY MEASURES
R OR PRECAUTIONS REQUIRED. POST SB.OL.593-
R 73-9057-102 TUBES MUST HAVE ARALOK 210
R FOR LOCAL TOUCH-UP.

(6) Check that a minimum clearance of 0.2 in. (5 mm) (Ref.75-21-12, Removal/Installation) is maintained between the tube and the hydraulic pump flexible drain pipe support bracket on engines No.2 and No.4. If this clearance is not obtained, refer to S.B.OL.593-75-14 and 75-8584-18.

(7) Pressure test tube connections and check for leaks (Ref.73-00-00). Close bleed valve and install dust cap and drain valve pressure cap concurrent with pressure test.

(8) Secure seal drains tubes to junction.

(a) Apply lubricant A to fluid passage bolt.

(b) Assemble a new seal washer to each side of multi-connector and secure to flange with fluid passage bolt, torque-tightened to between 150 and 170 lbf in. (16,9 and 19,2 N.m).

(c) Wire-lock fluid passage bolt.

D. Complete the Installation.

(1) On satisfactory completion of the pressure test, complete installation of the tube as follows:

(a) Remove safety clips and reset the circuit breakers (Ref. Table 401) concurrent with paragraph C. procedure.

(b) Close engine bay doors (Ref.71-00-00, Servicing).

TUBES, FUEL CONTROL UNIT SUPPLY TO MANIFOLD - REMOVAL/INSTALLATION

1. General

The fuel tubes from the fuel control unit (FCU) to fuel manifold are in three sections, fuel control unit to engine flowmeter, distribution block to upper manifold and distribution block to lower manifold.

The removal and installation procedures applicable to the first section are given in paragraph 2.

For details of lubricants quoted in this chapter, refer to 70-00-01, Servicing and Storage Materials.

2. Tube (Ref. Fig. 401)

A. Prepare to Remove Tube Section.

(1) Open engine bay front doors on engines No.1 and 3 and engine bay front lower doors on engines No.2 and 4 (Ref.71-00-00, Servicing).

(2) Ensure that the LP fuel isolation valve of an installed engine and that the valve indicator shows shut, then remove the throttle valve actuator gearbox (Ref.76-11-01).

(3) Remove tube, first stage pump and FCU to connection on second stage pump (Ref.71-73-04).

B. Remove Tube.

(1) Detach clamp assemblies of tube and reheat flowmeter electrical lead from support bracket.

(2) Unscrew union nut securing servo spill tube to union connection at tube flange at flowmeter end.

(3) Remove bolts and nuts securing tube flange to FCU and withdraw seal plate.

(4) Disconnect fuel tube from flowmeter.

(a) Remove the three bolts secured by nut plate assembly.

(b) Remove nut and bolt securing flowmeter flange and nut plate assembly to fuel tube flange.

FLOW CONTROL UNIT

ACTUATOR GEARBOX (TV)

MAIN OIL PUMP

A

CMR 73 13 02 4 AAM0

Tube Section and Location Details
Figure 401

(c) Remove bolts from remaining two locations at flowmeter flange and withdraw seal plate.

(d) Remove nuts and bolts and detach tube flange from support bracket.

(5) Remove tube from engine.

(6) If tube is to be renewed, transfer clamp assembly to a similar position on the tube to be installed.

C. Install Tube.

Apply lubricant B to tube flange attachment nuts and bolts, union connection on servo spill tube and clamp assembly attachment nuts and bolts.

(2) Position tube on engine, locate a new seal plate between flanges and secure tube flange to FCU with four bolts lightly tiightened.

(3) Connect fuel tube to flowmeter.

(a) Carefully insert new seal plate between flanges, ensuring that the flat of the plate is against electrical connection position.

(b) Position nut plate assembly against flowmeter flange and secure with lightly tightened nut and bolt.

(c) Assemble three bolts through fuel tube and flow-
R meter flanges to engage with the three nuts of
R the nut plate assembly. Lightly tighten bolts.

(d) Assemble bolts at the remaining two locations and lightly tighten.

(e) Secure tube flange to support bracket with two nuts and bolts.

(4) Attach tube and reheat flowmeter electrical connection lead clamp assemblies to support bracket with nut, bolt and flat washer, torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(5) Torque-tighten tube flange bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(6) Engage servo spill fuel tube to union connection at flange at flowmeter end of tube. Torque-tighten to

between 190 and 210 lbf in. (21,5 and 23,5 N.m).
Wire-lock nut.

D. Complete the Installation.

(1) Install tube, first stage pump and FCU to connection, on second stage pump (Ref.71-73-04).

R (2) Install throttle valve actuator gearbox
R (Ref.76-11-01).

(3) Pressure test tube connections and check for leaks (Ref.73-00-00) and open LP fuel isolation valve concurrent with pressure test.

(4) Close engine bay doors (Ref.71-00-00, Servicing).

R TUBE - FIRST STAGE PUMP SUPPLY TO REHEAT INJECTION SYSTEM - SERVICING

1. General

This procedure relates to the reheat fuel filter incorporated in the tube extending from the first stage fuel pump to the reheat flowmeter.

2. Tools and Equipment

Circuit braker safety clip ... ...

3. Filter Removal/Installation (Ref. Fig. 301)

A. Prepare to Remove Filter.

(1) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 301 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C 1
LP VALVE SUP 2	16-215	1Q2	-
Engine No.2			
LP VALVE SUP 1	15-216	2Q1	F 2
LP VALVE SUP 2	15-215	2Q2	C19

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.3			
LH VALVE SUP 1	15-216	3Q1	F 1
LH VALVE SUP 2	15-215	3Q2	C20
Engine No.4			
LH VALVE SUP 1	15-216	4Q1	C 2
LH VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 301

(4) Drain filter.

(a) Break wire-locking, loosen blanking ferrule and allow fuel to drain into a container.

(b) When draining is complete, remove blanking ferrule, apply lubricant A (71-00-01), reassemble ferrule and torque-tighten to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock ferrule to blanking plate.

B. Remove Filter.

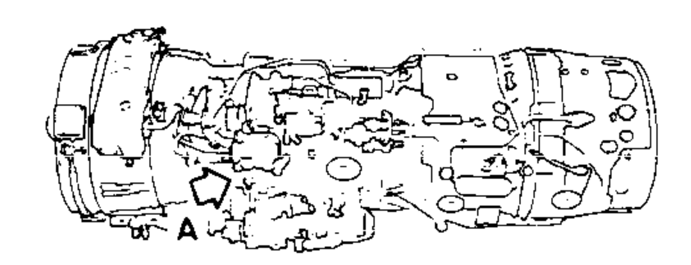
R (1) Support detached electrical leads bracket, remove nuts and bolts securing blanking plate to tube and remove blanking plate.

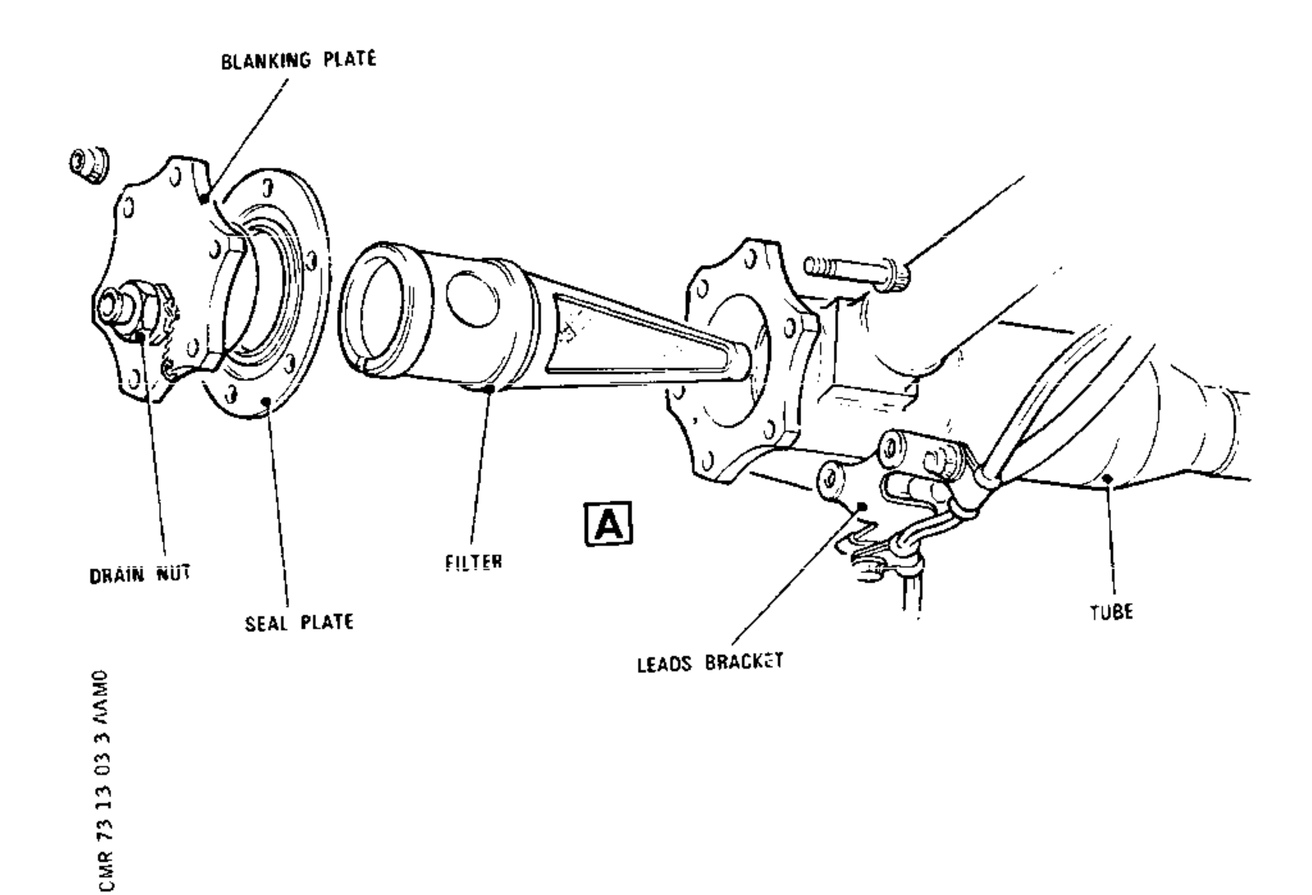
(2) Remove seal plate and withdraw filter from tube.

(3) Examine filter for serviceability and remove any contamination on filter gauze by washing with clean approved fuel.

C. Install Filter.

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Filter Element - Removal/Installation
Figure 301

R (1) Apply lubricant B (Ref.70-00-01, Servicing and Stor-
R age materials) to attachment bolts and nuts.

R (2) Insert filter fully into tube with filter side port
R in alignment with fuel tube inlet.

R (3) Assemble serviceable seal plate (Ref.70-00-03,
R Sealing Devices) to blanking plate with attachment
R holes aligned.

R (4) Engage lug on blanking plate spigot with assembly
R slot on filter face and press cover and seal into
R position with attachment holes of flanges aligned.
R Retain in position with two bolts and nuts in
R opposite side positions lightly tightened.

R (5) Align electrical leads bracket with the two lower
R bolt holes.

R (6) Assemble remaining four bolts and nuts to retain
R bracket, seal plate and blanking plate to tube.

R (7) Torque-tighten bolts in a diametrically opposed se-
quence to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

D. Complete Installation.

(1) Remove safety clip and reset LP fuel isolation valve circuit breaker (Ref. Table 301).

(2) Carry out a leak check in accordance with 73-00-00. Adjustment/Test.

(3) Close engine bay doors (Ref.71-00-00, Servicing).

TUBES - FIRST STAGE PUMP SUPPLY TO REHEAT INJECTION SYSTEM
REMOVAL/INSTALLATION

1. General

R The fuel tubes from the first stage pump to reheat injection system are in two sections, from the pump to the inlet of the reheat flowmeter and from the outlet of the reheat controller to the spray ring connection.

The removal/installation procedure for the tube section,
R pump to the inlet of the reheat flowmeter is given in paragraph 3, and that for the rear tube section, reheat controller
R to spray ring, is given in paragraph 4.

Details of clamp assemblies are shown in the illustrations
R (Ref. Fig. 402, 403 and 404).

Details of lubricants quoted in this chapter are given in 71-00-01, Servicing and Storage Materials.

2. Tools and Equipment

Crowfoot spanner, for castellated union nut ... PE.3758

R 3. Tube - First stage pump to Reheat Flowmeter (Ref. Fig. 403)

R A. Prepare to Remove Tube (Ref. Fig.401 and 402)

(1) Open engine bay rear doors (Ref. 71-00-00, Servicing).

R (2) Disconnect hydraulic hoses at self-sealing couplings
R and restrain clear of work area (Ref.71-00-12,
R Removal/Installation). Do not distort or stress
R hoses.

R (3) Remove air turbine starter cross-feed tube (Ref.
R 71-00-12, Removal/Installation).

R (4) Electrically isolate the engine services indicated
R in Table 401 by tripping the circuit breakers
R affecting the engine upon which the work is to be
R carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R	Engine No.1			
R	RH IGNITION SUP	1-213	1J4	N5
R	LH INGITION SUP	2-213	1J3	E12

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R Engine No.2			
R RH IGNITION SUP	1-213	2J4	P5
R LH IGNITION SUP	2-213	2J3	B10
R Engine No.3			
R RH IGNITION SUP	1-213	3J4	Q5
R LH IGNITION SUP	2-213	3J3	B11
R Engine No.4			
R RH IGNITION SUP	1-213	4J4	R5
R LH IGNITION SUP	2-213	4J3	E13

Circuit Breakers
Table 401

R WARNING: DISCONNECT LOW TENSION SUPPLY TO IGNITION
R UNITS AT LEAST ONE MINUTE BEFORE ATTEMPTING
R TO DISCONNECT HIGH ENERGY (HE) LEAD.
R ELECTRICAL DISCHARGE FROM IGNITION UNITS
R IS POTENTIALLY LETHAL.

R (5) Disconnect and detach high energy (HE) ignition
R leads (Ref. Fig. 401).

R (a) Disconnect low tension (LT) ignition lead and
R wait at least one minute before disconnecting
R HE leads.

R (b) Unscrew union units and detach both lead ends
R from HE ignition unit.

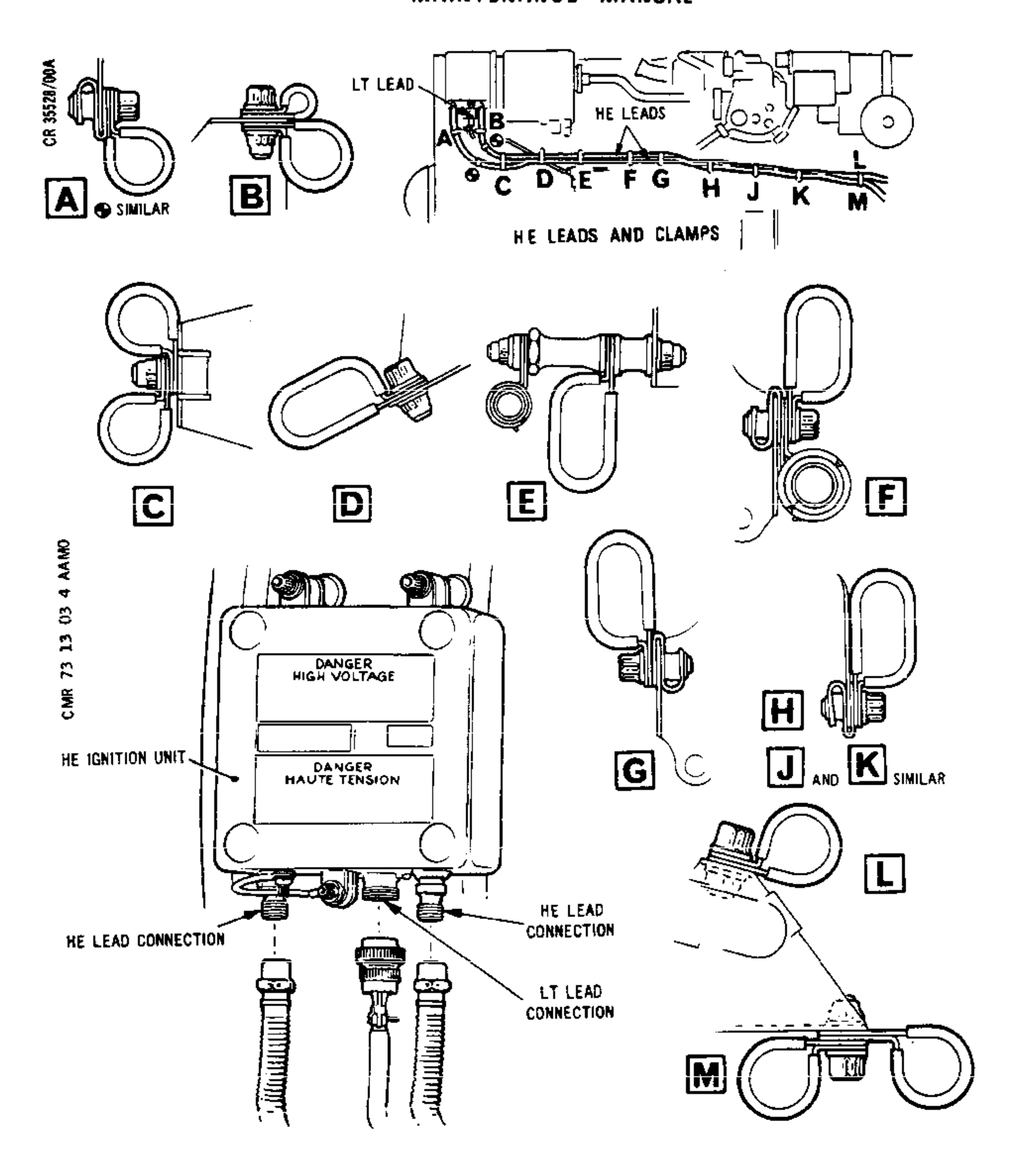
R (c) Detach clamps supporting leads at all positions
R from the HE ignition unit to the position level
R with the oil tank vent seal plate.

R (6) Remove vent tube sections, flanged connector to union
R connection and union connection to outlet seal plate
R (Ref.75-02-09).

R (7) Remove two rear sections of vent tube, air starter to
R outlet seal plate (Ref.75-02-10).

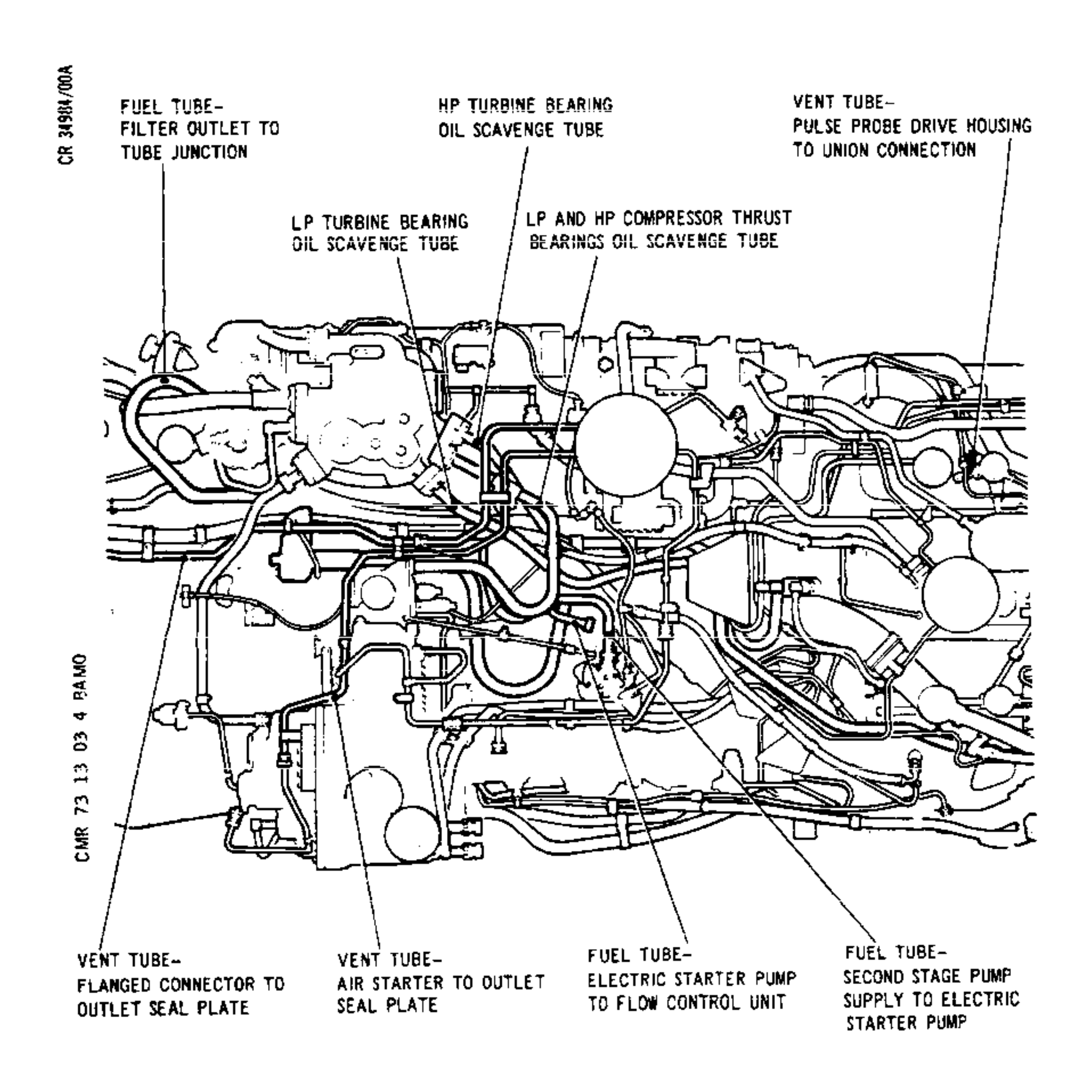
Details

R (8) Remove tube - LP and HP compressor thrust bearings
R oil scavenge and HP turbine bearing oil scavenge



High Energy (HE) Ignition Leads Attachment
Figure 401

R



Preparation for Tube Removal
Figure 402

R

R (Ref.72-01-04).

R (9) Remove LP turbine bearing oil scavenge tube (front
R section).

R (a) Position a container to catch oil drainage,
R unscrew tube union nut and remove bolts securing
R tube flange to oil pump.

R (b) Detach tube clamp assemblies from support
R brackets and remove tube from engine.

R (10) Remove fuel tube - second stage pump supply to
R electric starter pump (Ref.73-13-04).

R (11) Remove fuel tube - electric starter pump to flow
R control unit (Ref.73-13-05).

R (12) Remove fuel tube - filter outlet to tube junction
R (Ref.73-13-01).

R (13) Remove vent tube - pulse probe, drive and housing
R to union connection (Ref.75-02-11).

R (14) Remove reheat flowmeter (Ref.73-33-02).

R B. Complete Tube Removal (Ref. Fig. 403)

R (1) Remove bolts securing tube flange to first stage pump.

R (2) Support tube, remove bolt, flat washer and nut
R securing each clamp assembly to support bracket, then
R detach tube from engine.

R (3) If tube is to be renewed, remove filter element and
R clamp assemblies (Ref.73-13-03 Servicing).

R C. Prepare to Install Tube.

R (1) If a replacement tube is to be installed assemble
R the filter element (Ref.73-13-03 Servicing).

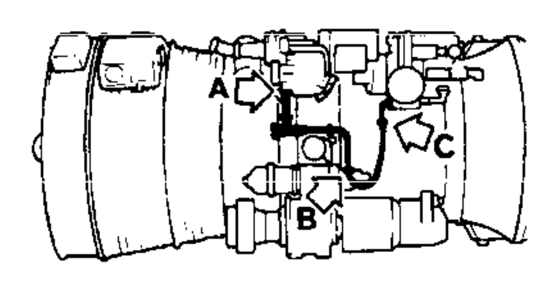
R (2) Install clamp assemblies to the tube.

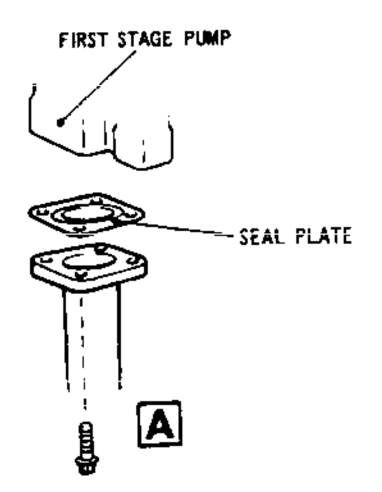
R D. Install Tube.

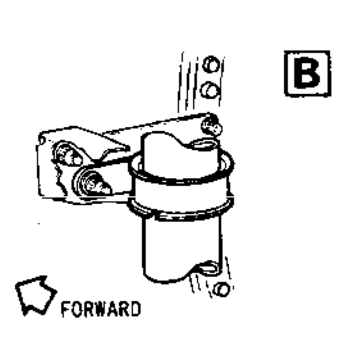
R (1) Apply lubricant B to tube flange attachment bolts and
R clamp assembly items.

R (2) Support tube in position on engine and attach to FSP

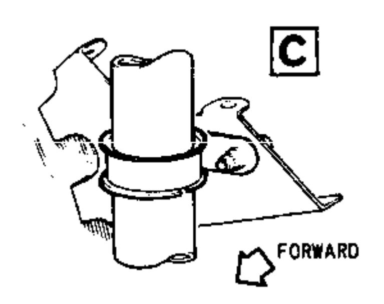
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CMR 73 13 03 4 CAMO



Tube - First Stage Pump to Reheat Flowmeter
Figure 403

R

R and carefully insert serviceable seal plate (Ref.70-00-03, Sealing Devices) between the mating faces of tube flanges.

R (a) Locate seal between mating faces.

R (b) Secure tube flanges at first stage pump with four bolts lightly tightened.

R (c) Install reheat flowmeter and secure the tube (Ref.73-33-02).

R (i) Assemble two short bolts at the threaded hole locations and lightly tighten.

R (ii) Position nut plate assembly against flowmeter flange and secure at plain hole position with nut and bolt lightly tightened.

R (iii) Assemble three bolts through fuel tube and flowmeter flanges to engage with three nuts of the nut plate assembly. Lightly tighten bolts.

R (3) Secure each clamp assembly to its support bracket with bolt, flat washer and nut, torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

R (4) Torque-tighten nuts and bolts at both flanges to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

R E. Complete the Installation.

R (1) Install vent tube - pulse probe, drive and housing to union connection (Ref.75-02-11).

R (2) Install fuel tube - filter outlet to tube junction (Ref.73-13-01).

R (3) Install fuel tube - electric starter pump to flow control unit (Ref.73-13-05).

R (4) Install fuel tube - second stage pump supply to electric starter pump (Ref.73-13-04).

R (5) Pressure test reheat fuel tube section connections and check for leaks (Ref.73-00-00, Adjustment/Test) concurrent with the remaining fuel tube pressure checks.

(6) Install LP turbine bearing oil scavenge tube (front section).

(a) Apply lubricant A to union connection. Apply lubricant B to tube flange attachment bolts and clamp assembly items.

(b) Hold tube on engine and with a gasket positioned between tube flange and oil pump, attach tube flange and support bracket with five bolts lightly tightened. Position the two longer bolts at the bracket location.

(c) Connect and hand tighten union nut.

(d) Attach and secure tube clamp assemblies to support bracket as shown. Torque-tighten assembly items to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(e) Torque-tighten tube flange securing bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(f) Torque-tighten union nut to between 490 and 550 lbf in. (55 and 62 N.m). Wire-lock nut.

(7) Install tube - LP and HP compressor thrust bearings oil scavenge (Ref.72-01-04).

(8) Install tube and HP turbine bearing oil scavenge (Ref.72-01-04).

(9) Install two rear sections of vent tube, air starter to outlet seal plate (Ref.75-02-10).

(10) Install vent tube sections, flanged connector to union connection and union connection to outlet seal plate (Ref.75-02-09).

(11) With the oil tank full (Ref.12-13-70, Servicing) and the overflow drain connection drain plug installed, add a quantity of oil to the tank equivalent to that drained during removal procedure.

(12) Connect HE ignition leads and secure in position with supporting clamps (Ref. Fig. 401).

(a) With leads supported, connect lead end nuts hand-tight on their respective ignition unit connections.

R (b) Apply lubricant B to clamp attachment items and attach clamps to their locations without tightening nuts and bolts.

R (c) Torque-tighten lead and union nuts to the following values.

R (i) On pre S.B.OL.593-74-5 engines: to between 10 and 15 lbf ft (13,6 and 20,3 N.m).

R (ii) On S.B.OL.593-74-5 engines: to between 20 and 25 lbf ft (27 and 34 Nm).

R (d) Wire-lock nuts together.

R (e) Ensure that leads are evenly disposed between their support points and torque-tighten clamp attachment nuts and bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

R (f) Connect, tighten and wire-lock LT supply lead.

R (g) Remove safety clips and reset circuit breakers (Ref.Table 401).

R (h) Carry out ignition system test (Ref.74-00-00, Adjustment/Test)

R (13) On completion of work, close engine bay doors (Ref. 71-00-00, Servicing).

R 4. <u>Tube - Reheat Controller to Spray Ring</u> (Ref. Fig. 404)

R A. Prepare to Remove Tube.

R (1) Open engine bay rear doors (Ref.71-00-00, Servicing).

R (2) Remove tube - exhaust diffuser to duct (left-hand) (Ref.75-02-05) and duct - HP compressor diffuser case to overboard cowling (left-hand) (Ref.75-02-07).

R (3) Detach electrical lead tray support clamps from LP turbine oil feed tube.

R (4) Remove LP turbine bearing oil feed tube rear section.

R (a) Disconnect tube clamp assemblies from bracket positioned at U-shaped section of tube.

(b) Unscrew tube union nut at U-shaped section of tube.

(c) Unscrew tube union nut at rear end of tube.

(d) Remove tube section from engine.

R

B. Remove Fuel Tube.

(1) Remove clamp assemblies from the following locations:

(a) Bracket attached to LP shaft signal system cable flange.

(b) Bracket attached to flange on turbine exhaust diffuser case.

(2) Unscrew union nut at reheat control unit end of tube.

(3) Restrain elbow end piece with spanner and unscrew union nut at spray end of tube.

(4) If a tube is to be renewed, transfer blanking ferrule and clamp assemblies to tube to be installed.

C. Prepare to Install Fuel Tube.

(1) Blank off reheat spray ring elbow with a paraffin wax plug (Ref.73-12-06, Removal/Installation).

(2) Apply lubricant A to union nut of blanking ferrule.

(3) Screw on union nut and torque-tighten to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

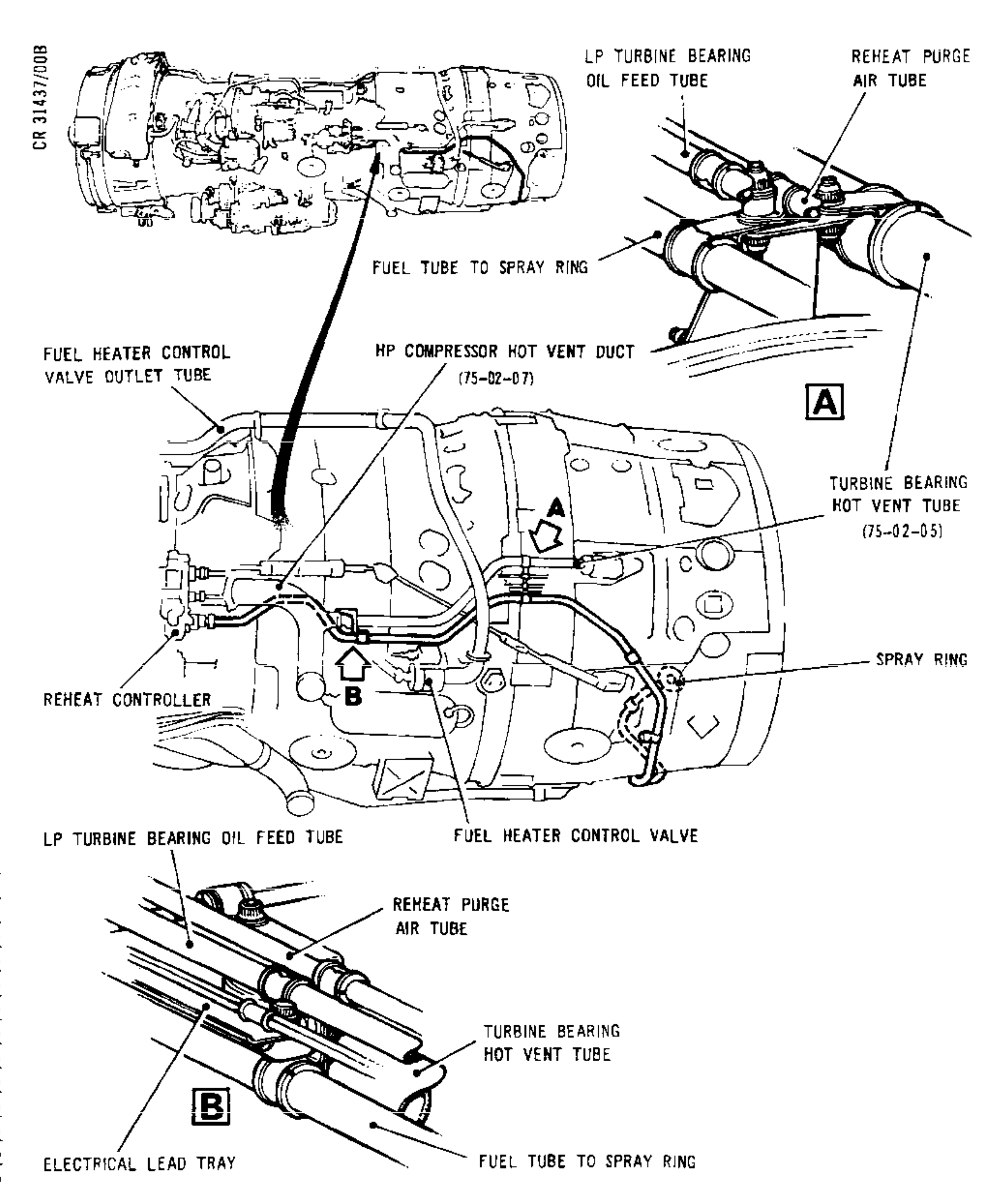
(4) Wire-lock nut.

D. Install Tube.

(1) Apply lubricant A to fuel tube union nuts.

(2) Position tube on engine and engage union nuts. Screw up both union nuts by hand until the visible part of the thread is less than 2,5 mm (0.10 in.).

(3) Secure tube with clamp assemblies.



Tube - Reheat Controller to Spray Ring
Figure 404

(a) Apply lubricant B to attachment bolts.

(b) Secure clamps to bracket at turbine exhaust diffuser case and LP shaft signal system cable flange with bolt, flat washer and nut torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(4) Torque-tighten tube union nuts:

(a) Union nut to reheat controller, to between 600 and 660 lbf in. (68 and 74 N.m).

(b) Restrain elbow end piece with spanner, tighten spray ring union nut to between 780 and 840 lbf in. (88 and 95 N.m).

(5) Pressure test reheat fuel system (Section 3) (Ref.73-00-00, Adjustment/Test).

(6) On satisfactory completion of pressure test, wire-lock union nuts at each end of tube.

R

E. Complete the Installation.

(1) Install LP turbine bearing oil feed tube.

(a) Apply lubricant B to union connection at exhaust diffuser and clamp assembly items, lubricant A to union at forward end of tube.

(b) Position tube section on engine and engage union nut at each end of tube.

(c) Secure clamp assemblies to bracket on combustion chamber outer case flange. Secure reheat purge air tube, fuel spray ring tube and oil feed tube clamps with pillar bolt, flat washer and nut. Torque-tighten nut to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(d) Torque-tighten union nut at forward end of tube to between 280 and 310 lbf in. (32 and 35 N.m) and rear end to between 490 and 550 lbf in. (56 and 62 N.m). Wire-lock nuts.

(2) Install electrical lead tray.

(a) Apply lubricant B to clamp assembly items.

(b) Secure two clamps to LP turbine bearing oil feed tube with bolt, flat washer and nut, one clamp to pillar bolt, torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

R

(3) Install tube - exhaust diffuser to duct (left-hand) (Ref.75-02-05) and duct - HP compressor diffuser case to overboard cowling (left-hand) (Ref.75-02-07).

(4) On completion of work, close engine bay doors (Ref. 71-00-00, Servicing).

TUBE - SECOND STAGE PUMP SUPPLY TO ELECTRIC STARTER PUMP - REMOVAL/INSTALLATION

1. Tools and Equipment

   Circuit breaker safety clip ... ...

2. Tube (Ref. Fig. 401)

   A. Prepare for Tube Removal.

      (1) Open engine bay front lower door (Ref.71-00-00, Servicing).

      (2) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

      (3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is being carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.1			
R	LP VALVE SUP 1	15-216	1Q1	C 1
R	LP VALVE SUP 2	16-215	1Q2	-
	Engine No.2			
R	LP VALVE SUP 1	15-216	2Q1	F 2
R	LP VALVE SUP 2	15-215	2Q2	C19
	Engine No.3			
R	LP VALVE SUP 1	15-216	3Q1	F 1
R	LP VALVE SUP 2	15-215	3Q2	C20
	Engine No.4			
R	LP VALVE SUP 1	15-216	4Q1	C 2
R	LP VALVE SUP 2	16-215	4Q2	-

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.

Circuit Breakers
Table 401

B. Drain Fuel from Starter Pump Section.

(1) Position container at starter pump, remove blanking ferrule and collect fuel drainage.

(2) Apply lubricant A (Ref.70-00-01, Servicing and Storage Materials) and install blanking ferrule. Torque-tighten to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock union nut.

C. Remove Tube.

(1) Unscrew union nuts at connections to the starter pump and the second stage pump inlet tube elbow.

(2) Detach supporting clamp assembly and remove tube from engine.

(3) If tube is to renewed, transfer clamp assembly to a similar postion on the tube to be installed.

D. Install Tube.

(1) Apply lubricant A to union connections and lubricant B to clamp assembly attachment items.

(2) Position tube on engine and engage union nuts hand-tight.

R (3) Attach clamp assembly to support bracket with bolt
R and nut torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

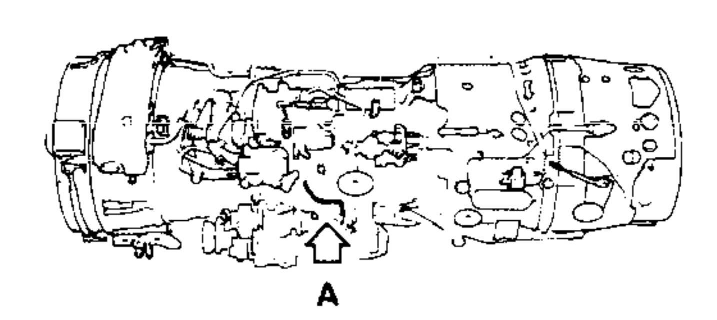
(4) Torque-tighten union nuts to between 310 and 340 lbf in. (35 and 38 N.m). Wire-lock nuts.

E. Complete the Installation.

(1) Pressurize and leak check drain point blanking ferrule and tube connections, using aircraft fuel feed pumps.

(a) Remove the safety clip and reset the LP fuel

CR 31054/008



FIRST STAGE PUMP TO SECOND STAGE PUMP CONNECTION BLOCK

PULSE PROBE DRIVE AND HOUSING

A

BLANKING FERRULE

STARTING PUMP

CMR 73 13 04 4 AAM0

Tube and Location Detail
Figure 401

isolation valve circuit breaker (Ref. Table 401).

(b) Ensure that all fuel connections are secure, open the LP fuel valve and start the appropriate aircraft fuel feed pumps.

(c) With feed pump pressure applied, check for signs of leakage. No leaks are acceptable.

(d) On safisfactory completion of check, switch off the aircraft feed pumps.

(2) Close engine bay door (Ref.71-00-00, Servicing).

TUBE - ELECTRIC STARTER PUMP TO FLOW CONTROL UNIT - REMOVAL/INSTALLATION

1. General

R The fuel tube from electric starter pump to flow control
R unit (FCU) filter housing is in two sections with union
R connections. Removal/Installation procedures are detailed
R in paragraph 3. Removal/Installation of the filter housing
R is given in paragraph 4.

2. Tools and Equipment

Circuit breaker safety clip ... ...

R 3. Tube - Removal/Installation (Ref. Fig. 401)

A. Prepare to Remove Tube.

(1) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.1			
R	LP VALVE SUP 1	15-216	1Q1	C1
R	LP VALVE SUP 2	16-215	1Q2	-
R				
R				
R	Engine No.2			
R				
R	LP VALVE SUP 1	15-216	2Q1	F2
R	LP VALVE SUP 2	15-215	2Q2	C19
R				
R				
R	Engine No.3			
R				
R	LP VALVE SUP 1	15-216	3Q1	F1
R	LP VALVE SUP 2	15-215	3Q2	C20

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.4			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 401

B. Remove Tube.

(1) Unscrew union nuts at starter pump, tube connections and FCU filter housing.

(2) Detach supporting clamp assemblies and remove tubes from engine.

(3) If tubes are to be renewed, transfer clamp assemblies to similar positions on the tubes to be installed.

C. Install Tube.

(1) Apply lubricant A to the union nuts at the tube connections and lubricant B to the clamp assembly attachment bolts.

(2) Position tube on engine and engage union nuts hand-tight.

(3) Attach clamp assemblies to support brackets with bolt, flat washer and clip nut, torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(4) Torque-tighten union nuts to between 280 and 310 lbf in. (31,6 and 35,0 N.m) and wire-lock them.

D. Complete the Installation.

(1) Pressure test tube connections and check for leaks. (Ref.73-00-00 Adjustment/Test).

(2) Upon completion of pressure test, remove safety clips and reset the circuit breakers (Ref. Table 401).

CR 31399/00B

FLOW CONTFOL UNIT

B

OIL TANK VENT OUTLET SEAL PLATE

FILTER HOUSING

SEAL PLATE

B

S B 73-8311-62

A

A

FLAT XASHER

A

ELECTRIC STARTER PUMP

CMR 73 13 05 4 AAMD

Tube Sections and Locations Details
Figure 401

R

(3) Close engine bay front lower door (Ref.71-00-00, Servicing).

4. Filter Housing - Removal/Installation

A. Prepare to remove filter housing as detailed in para.3A.

B. On engines to pre S.B.OL.593-73-8311-62 standard, remove housing and filter.

(1) Unscrew fuel tube union nut at FCU housing.

(2) Remove bolts securing filter and housing to FCU.

(3) Remove filter housing, filter and seal plates.

C. On engines to S.B.OL.593-73-8311-62 standard, remove housing.

(1) Unscrew fuel tube nut at FCU housing.

(2) Remove bolts securing housing to FCU.

(3) Remove housing and seal plate.

D. On engines to pre S.B.OL.593-73-8311-62 standard, install housing and filter.

(1) Apply lubricant B to bolts.

(2) Position serviceable seal plates between FCU and filter flange, and between filter flange and filter housing.

(3) Attach filter and filter housing to FCU with three bolts torque-tightened to between 67 and 73 lbf in.
R (7,6 and 8,2 N.m). Ensure that bolts are
R compatible with service bulletin standards.

(4) Apply lubricant A to union connections.

(5) Screw on union nut, then torque-tighten to between 280 and 310 lbf in. (31,6 and 35 N.m). Wire-lock nut.

E. On engines to S.B.OL.593-73-8311-62 standard, install housing.

(1) Apply lubricant B to bolts.

(2) Position a serviceable seal plate between housing

and FCU.

(3) Attach housing to FCU with three bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2
R N.m). Ensure that bolts are compatible with
R service bulletin standards.

(4) Apply lubricant A to union connections.

(5) Screw on union nut, then torque-tighten to between 280 and 310 lbf in. (31,6 and 35 N.m). Wire-lock nut.

F. Complete the Installation.

(1) Pressure test tube connections and check for leaks (Ref.73-00-00 Adjustment/Test).

(2) Upon completion of pressure test, remove safety clips and reset the circuit breakers (Ref. Table 401).

(3) Close engine bay front lower door (Ref.71-00-00, Servicing).

R TUBES, ELECTRIC STARTER PUMP SUPPLY TO FUEL PRESSURE ATOMOZING
R (PILOT) NOZZLES - REMOVAL/INSTALLATION

1. General

The fuel tubes from the starter pump are in five sections, starter pump to union connection, union connection to the distribution and dump valve, distribution and dump valve to bolted tube adapter, tube adapter to pilot atomizing nozzle - left-hand (short) tube and junction to pilot atomizing nozzle - right-hand (long) tube.

The removal and installation procedures applicable to each section are given, in sequence, in paragraphs 3 to 7.

For details of lubricants quoted in this chapter, refer to 70-00-01, Servicing and Storage Materials.

2. Tools and Equipment

Circuit breaker safety clip ... ...

3. Tube, Starter Pump to Union Connection
(Ref. Fig. 401)

A. Prepare to Remove Tube Section.

(1) Close the LP fuel isolation valve of an installed engine and ensure the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.1			
LP Fuel Shut-off Valve	15-216	1Q1	C
	1-213	1Q2	J11
Engine No.2			
LP Fuel Shut-off Valve	15-215	2Q1	C19
	3-213	2Q2	A5

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.3			
LP Fuel Shut-off Valve	15-215	3Q1	C20
	3-213	3Q2	A6
Engine No.4			
LP Fuel Shut-off Valve	15-216	4Q1	C2
	1-213	4Q2	J12

Circuit Breakers
Table 401

B. Remove Tube.

(1) Unscrew union nuts at starting pump and tube connection to next section.

(2) Detach supporting clamp assemblies from their brackets and remove tube from engine.

(3) If tube is to be renewed, transfer clamp assemblies to a similar position on the tube to be installed.

C. Install Tube.

(1) Apply lubricant A to union connections and lubricant B to clamp assembly attachment nuts and bolts.

(2) Position tube on engine and engage union nuts hand-tight.

(3) Secure clamp assemblies to support brackets with bolt, flat washer and clip nut torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(4) Torque-tighten union nuts to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock union nuts.

(5) Complete the installation as detailed in paragraph 8.

4. Tube Union Connection to Distribution and Dump Valve (Ref. Fig. 401)

A. Prepare to Remove Tube Section.

CR 30917/008

UNION CONNECTION

DISTRIBUTION AND
DUMP VALVE

TUBE ADAPTER

CMR 73 13 06 4 AAM0

PILOT ATOMIZING NOZZLES

STARTER PUMP

A

R

Tube Sections and Location Details
Figure 401

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(1) Carry out the procedure detailed in paragraph 3.A.

(2) On engines No.2 and No.4, remove engine fuel flowmeter (Ref.73-33-01, Removal/Installation).

B. Remove Tube.

(1) Unscrew union nut at tube connection to adjacent section.

(2) Remove bolts securing tube flange to dump valve.

(3) Detach supporting clamp assembly from bracket and remove tube from engine.

(4) If tube is to be renewed, transfer clamp assembly to a similar position on the tube to be installed.

C. Install Tube.

(1) Apply lubricant A to union connection and lubricant B to tube flange attachment bolts and clamp assembly items.

(2) Position tube on engine, align connection and engage union nut hand-tight.

(3) Insert a new seal plate between tube flange and dump valve faces. Secure flange with four bolts lightly tightened.

(4) Secure clamp assembly to support bracket with bolt, flat washer and nut torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m). Locate flat washer against clamp.

(5) Torque-tighten tube flange bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(6) Torque-tighten union connection to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock nut.

(7) Complete the installation as detailed in paragraph 8. On engines No.2 and No.4, install engine fuel flow-meter (Ref.73-33-01, Removal/Installation).

5. <u>Tube, Distribution and Dump Valve to Tube Adapter</u> (Ref. Fig. 401)

A. Prepare to Remove Tube Section

(1) On engines No.1 and No.3, carry out the procedure detailed in paragraph 3.A.

(2) On engines No.2 and No.4, remove engine (Ref.71-00-00, Removal/Installation).

B. Remove Tube.

(1) Slacken the two bolts securing fuel system air bleed valve to bracket.

(2) Remove bolts securing tube flange and bleed valve bracket to dump valve.

(3) Unscrew union nuts at tube adapter.

(4) Remove nuts and bolts securing tube adapter to support bracket.

(5) Detach supporting clamp assemblies from brackets and remove tube from engine.

(6) If tube is to be renewed, transfer clamp assemblies to similar positions on the tube to be installed.

C. Install Tube.

(1) Apply lubricant A to union connections and lubricant B to tube flange attachment bolts and clamp assemblies items.

(2) Position tube on engine with a new seal plate between tube flange and dump valve faces.

(3) Position fuel system bleed valve bracket against tube flange and secure assembly with four bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(4) Torque-tighten two bolts and nuts securing bleed valve to bracket to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(5) Engage left and right-hand tube union nuts to tube adapter hand-tight.

(6) Secure clamp assembly to bracket at HP compressor diffuser case vent duct with bolt, flat washer and nut. Secure clamp assembly to bracket at HP compressor diffuser case blanking cover with bolt, flat washer and clip nut. Torque-tighten bolts and nuts to

between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(7) Secure tube adapter to support bracket with two bolts and nuts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(8) Torque-tighten union nuts to between 190 and 210 lbf in. (21,5 and 23,5 N.m) and wire-lock nuts.

(9) On completion of work, engines No.2 and No.4, install engine (Ref.71-00-00, Removal/Installation), check tube for leaks and close engine bay doors concurrent with engine installation checks.

(10) On engines No.1 and No.3, complete the installation as detailed in paragraph 8.

6. Tube, Adapter to Pilot Atomizing Nozzle - Left-hand Tube (Ref. Fig. 401)

A. Prepare to Remove Tube Section.

(1) Carry out the procedure detailed in paragraph 3.A.

B. Remove Tube.

(1) Unscrew union nuts at tube adapter and pilot atomizing nozzle.

(2) Detach supporting clamp assembly and remove tube from engine.

(3) If tube is to be renewed, transfer clamp assembly to a similar position on the tube to be installed.

C. Install Tube

(1) Apply lubricant A to union connections and lubricant B to clamp assembly bolt and nut.

(2) Position tube on engine and engage union nuts at tube adapter and pilot atomizing nozzle hand-tight.

(3) Secure clamp assembly to mounting bracket with bolt, washer and nut torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m). Locate flat washer against clamp.

(4) Torque-tighten union nuts to between 190 and 210

lbf in. (21,5 and 23,5 N.m). Wire-lock nuts.

(5) Complete the installation as detailed in paragraph 8.

7. Fuel Tube - Adapter to Pilot Atomizing Nozzle - Right-hand Tube (Ref. Fig. 401)

A. Prepare to Remove Tube Section

(1) Carry out the procedure detailed in paragraph 3.A.

B. Remove Tube.

(1) Unscrew union nuts at tube adapter and pilot atomizing nozzle.

(2) Detach supporting clamp assemblies and remove tube from engine.

(3) If tube is to be renewed, transfer clamp assemblies to similar position on tube to be installed.

C. Install Tube.

(1) Apply lubricant A to union connections and lubricant B to clamp assembly bolt and nut.

(2) Position tube on engine and engage union nuts at tube adapter and pilot atomizing nozzle hand-tight.

(3) Secure clamp assemblies to mounting brackets with bolts, washers and nuts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m). Locate flat washer against clamp.

(4) Torque-tighten union nuts to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock nuts.

(5) Complete the installation as detailed in paragraph 8.

8. Complete the Installation

A. Complete the installation of a tube section follows:

(1) Pressure test tube connection and check for leaks; refer to 73-00-00 and open L.P. fuel isolation valve concurrent with pressure test.

(2) On completion of pressure test, remove safety clips and reset circuit breakers (ref.Table 401).

TUBES - REHEAT FUEL CONTROLLER AND FLOW CONTROL UNIT SPILL TO FIRST STAGE PUMP INLET ELBOW - REMOVAL/INSTALLATION

1. General

The fuel tubes from the reheat fuel controller to first stage pump inlet elbow are in five sections, first stage pump inlet elbow to union connection (Ref.para.3), union connections to multi-connection centre assembly (Ref.para.4), multi-connection centre assembly (Ref.para.5), multi-connection centre assembly to connection block (Ref. para.6) and connection block to reheat fuel controller (Ref.para.7).

Details of clamp assemblies are shown. (Ref. Fig. 401).

If tubes are to be renewed, transfer clamp assemblies to similar positions on the tubes to be installed.

Details of lubricants quoted in this chapter are given in 70-00-01, Servicing and Storage Materials.

2. Tools and Equipment

Air bleed tube	PE.22898
Drain tube	PE.34076
Circuit breaker safety clip	-

3. Tube - First Stage Pump Inlet Elbow to Union Connection (Ref. Fig. 401) (Tube A)

A. Prepare to Remove a Tube.

(1) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

(2) Open engine bay front and rear lower doors (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engines upon which work is to be carried out. Attach safety clips.

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FIRST STAGE PUMP INLET ELBOW
FIRST STAGE PUMP
FCU
TUBE C
DISTRIBUTION AND DUMP VALVE
REHEAT FUEL CONTROLLER
TUBE A
TUBE B
TUBE D
CONNECTION BLOCK
TUBE E
SEAL PLATES
SPILL CONNECTION
TUBE C MULTI-CONNECTION CENTRE ASSEMBLY
LP SENSING VALVE CONNECTION
TUBE D
TUBE E
TUBE E
CLIP NUT
SIMILAR AT TUBE B
TUBE A
FLAT WASHER
FLAT WASHER
SPACER
TUBE D
FLAT WASHER
TUBE B

Tube Sections and Location Details
Figure 401

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP Fuel Shut-off Valve	15-216	1Q1	C1
	1-213	1Q2	J11
Engine No.2			
LP Fuel Shut-off Valve	15-215	2Q1	C19
	3-213	2Q2	A5
Engine No.3			
LP Fuel Shut-off Valve	15-215	3Q1	C20
	3-213	3Q2	A6
Engine No.4			
LP Fuel Shut-off Valve	15-216	4Q1	C2
	1-213	4Q2	J12

Circuit Breakers
Table 401

(4) Drain engine fuel system.

(a) Utilize the air bleed valve near the fuel distribution and dump valve and fuel inlet drain valve and drain the system.

(b) When fuel drain ceases, remove the drain tool and close the bleed valve leaving the bleed tube in position for use during pressure test sequence.

B. Remove Tube.

(1) Unscrew union nut connecting tube A to tube B.

(2) Remove bolts securing tube flange to first stage pump inlet connection and remove tube.

C. Install Tube.

R (1) Apply lubricant B to tube flange securing bolts

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R and lubricant A to tube union connection.

(2) Position tube on engine, insert a new seal plate between tube flange and first stage pump faces, then assemble four bolts.

(3) Engage union nut hand-tight.

(4) Torque-tighten flange bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(5) Torque-tighten union nut to between 400 and 440 lbf in. (45 and 49 N.m). Wire-lock union nut.

(6) Complete the installation detailed in paragraph 8.

4. <u>Tube - Union Connection to Multi-connection Centre Assembly</u> (Tube B)

A. Prepare to Remove Tube.

(1) Carry out procedure detailed in paragraph 3A.

B. Remove Tube.

(1) Unscrew union nuts at tube connections.

(2) Detach clamp assembly from bracket at LH gearbox flange. Note assembly sequence of clamps at this position.

(3) Detach clamp assembly at LP compressor case bracket. Remove tube.

C. Install Tube.

R (1) Apply lubricant A to clamp assembly items and
R lubricant B to union connections.

(2) Position tube on engine and engage union nuts hand-tight.

(3) Assemble clamp assemblies to brackets as follows:

(a) To LH gearbox flange with bolt, flat washer and nut.

(b) To LP compressor case flange with bolt, flat washer and clip nut.

(c) Torque-tighten to between 85 and 95 lbf in.

(9,6 and 10,7 N.m).

(4) Torque-tighten union nuts to between 400 and 440 lbf in. (45 and 49 N.m). Wire-lock nuts.

(5) Complete the installation as detailed in paragraph 8.

5. Tube - Multi-connection Centre Assembly (Tube C)

A. Prepare to Remove Tube.

(1) Remove flow control unit (FCU) second stage pump assembly from engine as detailed in 73-21-01 Removal/Installation.

B. Remove Tube from FCU.

(1) Remove bolts securing tube flange to spill connection at low pressure sensing valve location on FCU.

(2) Remove bolts securing tube flange to spill connection on bottom of FCU.

(3) Remove tube from assembly.

C. Install Tube on FCU.

R (1) Apply lubricant B to assembly items.

(2) Hold tube in position and insert new seal plates at tube flange positions, then loosely retain flanges with bolts.

R (3) Torque-tighten tube flange bolts to between 67 and
R 73 lbf in. (7,6 and 8,2 N.m).

(4) Install flow control unit/second stage pump assembly on engine as detailed in 73-21-01 Removal/Installation.

6. Tube - Multi-connection Centre Assembly to Connection Block (Tube D)

A. Prepare to Remove Tube.

(1) Carry out the procedure detailed in paragraph 3A.

B. Remove Tube.

(1) Unscrew union nuts from connection block and centre assembly.

(2) Remove bolt, spacer and nut, detach clamp assembly from bracket.

C. Install Tube.

R (1) Apply lubricant A to union connections and lubricant B
R to assembly attachment items.

(2) Position tube on engine and engage union connections hand-tight.

(3) Attach clamp assembly to support bracket with bolt, spacer and nut, torque-tightened to 85 and 95 lbf in. (9,6 and 10,7 N.m).

(4) Torque-tighten union nuts to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock nuts.

(5) Complete the installation detailed in paragraph 8.

7. Tube - Connection Block to Reheat Fuel Controller (Tube E)

A. Prepare to Remove Tube.

(1) Remove reheat fuel controller from engine as detailed in 73-23-01 Removal/Installation.

B. Remove Tube from Controller.

(1) Unscrew union nut at controller and connection block.

(2) Detach tube clamp assembly from bracket and remove tube from controller.

C. Install Tube on Controller.

R (1) Apply lubricant A to union connections and lubricant
R B to clamp assembly items.

(2) Position tube on controller and engage union nuts hand-tight.

(3) Attach clamp assembly to support bracket with bolt, flat washer and clip nut, torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(4) Torque-tighten reheat fuel controller union nut to

between 220 and 240 lbf in. (25 and 27 N.m).

(5) Torque-tighten connection block union nut to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(6) Wire-lock union nuts.

(7) Install reheat fuel controller on engine as detailed in 73-23-01 Removal/Installation.

8. Complete the Installation

A. Complete the Installation of a Tube as follows:

(1) Pressure test tube connections and check for leaks (Ref.73-00-00).

(2) On completion of pressure test, remove safety clips and reset the circuit breakers (Ref.Table 401).

(3) Close engine bay doors (Ref.71-00-00, Servicing).

TUBE - SECOND STAGE PUMP INLET TO RECIRCULATION VALVE - REMOVAL/INSTALLATION

1. General

The fuel tube is in one section supported by three clamp assemblies. A flanged connection is used at the recirculation valve inlet and a union connection at the pump inlet elbow connection.

Details of lubricants quoted in this chapter are given in 70-00-01, Servicing and Storage Materials.

2. Tools and Equipment

Air bleed tube	PE.22898
Drain tube (Pre S.B.OL.593-73-1 drain valve) ...	PE.34076
Drain tube (S.B.OL.593-73-1 drain valve)	PE26796
Drain tube for heater and filter drain valve ...	PE.21970
Circuit breaker safety clip	-

3. Tube - Removal/Installation

A. Prepare to Remove.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front doors on engines No.1 and No.3 and engine bay front lower door on engines No.2 and No.4.

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	L5-216	1Q1	C1
LP VALVE SUP 2	L6-215	1Q2	-
RH IGNITION SUP	1-213	1J4	N5

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	LH IGNITION SUP	2-213	1J3	E12
	FUEL RECIRC VALVE CONT	3-213	1Q791	G1
	Engine No.2			
	LP VALVE SUP 1	15-216	2Q1	F2
	LP VALVE SUP 2	15-215	2Q2	C19
	RH IGNITION SUP	1-213	2J4	P5
	LH IGNITION SUP	2-213	2J3	B10
	FUEL RECIRC VALVE CONT	1-213	2Q791	E5
	Engine No.3			
	LP VALVE SUP 1	15-216	3Q1	F1
	LP VALVE SUP 2	15-215	3Q2	C20
	RH IGNITION SUP	1-213	3J4	Q5
	LH IGNITION SUP	2-213	3J3	B11
	FUEL RECIRC VALVE CONT	1-213	3Q791	E6
	Engine No.4			
	LP VALVE SUP 1	15-216	4Q1	C2
	LP VALVE SUP 2	16-215	4Q2	-
R	RH IGNITION SUP	1-213	4J4	R5
	LH IGNITION SUP	2-213	4J3	E13
	FUEL RECIRC VALVE CONT	3-213	4Q791	G2

Circuit Breakers
Table 401

(3) Drain the engine fuel system.

R (a) Open bleed valve to expedite draining.

R (b) Use drain tube PE.34076 (pre S.B.OL-593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE.21970 at the fuel heater and filter

drain valve. Direct free ends of drain tubes into a container and drain the system upstream of the FCU.

(c) When fuel drain ceases, remove the drain tubes and close the bleed valve.

R NOTE: Discard drained fuel or inhibiting fluid.

WARNING: DISCONNECT LOW TENSION SUPPLY TO IGNITION UNITS AT LEAST ONE MINUTE BEFORE ATTEMPTING TO DISCONNECT HIGH ENERGY (HE) LEAD. ELECTRICAL DISCHARGE FROM IGNITION UNITS IS POTENTIALLY LETHAL.

(4) Disconnect high energy (HE) ingition leads from high
R energy ignition unit and detach supporting clamps at all positions from the front to the position level with the second stage pump inlet elbow (Ref. Fig. 401).

(a) Disconnect low tension (LT) ignition lead and wait at least one minute before disconnecting HE leads.

(b) Unscrew union nuts and detach both lead ends from HE ignition unit.

(c) Detach the clamps from both leads and support the leads clear of the work area.

(5) Disconnect electrical lead end from the recirculation valve.

(6) Remove front section of the LP compressor front bearing oil scavenge tube (Ref.72-01-04, para.2).

(7) Detach the LP compressor front bearing oil feed tube and support in position on engine. Use free movement of tube to obtain withdrawl clearance for fuel tube removal at a later stage (Ref. Fig. 402).

(a) Position a container to catch oil drainage and unscrew union nut of LP and HP compressor thrust bearings oil feed tube.

(b) Remove bolts securing tube flange to oil pump.

(c) With container positioned under connection, unscrew tube union nut from flange assembly on

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L T LEAD
H E LEADS
A
B
C
D
E
F
G
H
J
SIMILAR
H E LEADS AND CLAMPS

DANGER
HIGH VOLTAGE
DANGER
HAUTE TENSION
HE IGNITION UNIT
HE LEAD CONNECTION
HE LEAD CONNECTION
LT LEAD CONNECTION
H AND J SIMILAR

CMR 73 13 09 4 AAMO

HE Ignition Leads and Associated Clamps
Figure 401

air intake case.

(d) Detach tube clamp assemblies and support tube on engine.

(e) Withdraw strainer assembly from its housing.

(f) On SB.79-3 standard engines, remove gasket from oil pump flange.

(g) Measure and record the quantity of oil drained.

(8) Detach clamp assemblies supporting the electrical harness at two positions to the rear of the oil tank and the next three clamp assemblies forward of these positions. Support the harness clear of the work area.

(9) On No.1 and No.3 engines, disconnect the hydraulic drain tube, supported by a clamp assembly at the recirculation valve, from the drains junction block.

(10) On No.1 and No.3 engines, remove bracket supporting hydraulic tubes and fuel recirculation drain block.

(a) Remove attaching nuts and bolts from hydraulic
R tube clamp blocks and drain block. Support tube clear of work area.

(b) Remove nuts and washers attaching support bracket to engine flange pillar bolts, note its orientation and withdraw bracket.

(11) Disconnect hydraulic hoses at self-sealing couplings and restrain clear of work area (Ref.71-00-12, Removal.Installation). Do not distort or stress hoses.

(12) On No.2 and No.4 engines, remove fuel tube, recirculation valve outlet to aircraft fuel system tube connection (Ref. Fig. 403).

(a) Disconnect aircraft fuel tube from flanged end
R connection of tube to be removed.

(b) Disconnect flexible drains tube from connector on flanged end connection.

(c) Remove bolts securing flanged end connection to support bracket.

CR 31454/00B

A

LP AND HP COMPRESSOR
THRUST BEARINGS
OIL FEED TUBE

GASKET (SB 79-3)

FLAT WASHER

WIRE LOCKING
BOLT

CLIPNUT

OIL PUMP

FLAT WASHER

A

CMR 73 13 09 4 BAMO

FLAT WASHER

AIR INTAKE CASE

SPACER

CLIPNUT

FLANGE ASSEMBLY

STRAINER ELEMENT

LP Compressor Front Bearing Oil Feed Tube
Figure 402

(d) Remove tube retaining clamp at recirculation valve outlet.

(e) Detach supporting clamp assembly from pillar bolt, disengage tube spigot from valve outlet and remove tube from engine.

(13) On No.2 and No.4 engines, remove nuts and washers and remove recirculation fuel pipe support bracket from flange mounted pillar bolts. Note orientation of bracket on removal. (Ref. Fig. 403).

(14) Remove fuel heater air exhaust duct supporting bracket and support strut. (Ref. Fig. 403).

(a) Remove bolts securing duct assembly to bracket and support strut.

(b) Remove bolts, flat washers and nut securing support strut to bracket mounted on LP compressor case flange and remove strut.

(c) Remove nuts securing bracket to LP compressor flange and support bracket and connected items clear of work area.

(15) Disconnect and remove the seal failure drains tube from the recirculation valve and inlet elbow drains connector.

B. Remove Fuel Tube, Second Stage Pump Inlet to Recirculation Valve (Ref. Fig. 404).

(1) Detach and remove the three tube supporting clamp assemblies noting their location and orientation.

(2) Unscrew the tube union nut at the pump inlet connection.

(3) Support the tube, remove the attaching bolts at the flanged connection on the recirculation valve and withdraw the seal plate.

(4) Withdraw the fuel tube from the engine. Move the detached tubes to allow the flanged end of the tube to be brought below the oil supply tube and be turned to allow tube to be drawn forward. If necessary to obtain additional withdrawl clearance, detach tubes or leads as detailed in the relevant chapter/topic.

WASHER
SUPPORT STRUT
WASHER
A

BRACKET
SUPPORT STRUT
X
Y
Z
B

AIRCRAFT ENGINE FUEL INLET TUBE
FUEL RECIRCULATION VALVE
DRAIN TUBE
FUEL HEATER AIR OUTLET DUCT
B
C
A

CR 35235 00A

Nos.2 AND 4 ENGINES

PILLAR BOLT
BRACKET
TUBE FLANGED END
DRAIN TUBES
RECIRCULATION RETURN TUBE
DRAIN TUBES
CONNECTOR
C

CMR 73 13 09 4 CAM0

Brackets and Recirculation Return Fuel
Tube Connections
Figure 403

C. Install Fuel Tube, Second Stage Pump Inlet to Recirculation Valve (Ref. Fig. 404).

(1) Position tube on engine.

(a) Pass protected union nut end of tube through from front of engine until flanged connection end can be turned to approximate installed position.

(b) Apply lubricant B to flange connection bolts and lubricant A to union connection.

(c) Support tube, interpose a servicable seal plate (Ref.70-00-03, Sealing Devices) between mating faces of flange connection and retain with four bolts lightly tightened. Screw on and lightly tighten union nut.

(d) Torque-tighten attachment bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m) and union nut to between 220 and 240 lbf in. (24,9 and 27,1 N.m).

(e) Wire-lock union nut.

(f) Assemble clamp assemblies to tube at three positions and orientated as noted during removal.

(g) Apply lubricant B and secure the three clamp assemblies as shown, with washer and nut at the two pillar bolt locations and bolt, washer and nut at the remaining location, torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

D. On No.2 and No.4 Engines, Install Support Bracket and Recirculation Valve Outlet to Aircraft Fuel System Fuel Tube (Ref. Fig. 403).

(1) Install recirculation fuel tube support bracket.

(a) Locate bracket on the two pillar bolts as shown/ noted during removal.

(b) Secure bracket with a washer and nut to each bolt torque-tightened to between 100 and 120 lbf in. (11,2 and 13,4 N.m).

(2) Install Fuel tube, recirculation valve outlet to

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OIL TANK

MAIN OIL PUMP

A

SECOND STAGE PUMP FUEL INLET ELBOW

B

D

OIL FEED TUBE

OIL SCAVENGE TUBE FRONT SECTION

C

TUBE, INLET ELBOW TO RECIRCULATION VALVE

TUBE UNION CONNECTION

SEAL PLATE

RECIRCULATION VALVE

A

FLAT WASHER

B

FLAT WASHER

FLAT WASHER

D

C

CMR 73 13 09 4 0AM0

Fuel tube-Second Stage Pump Inlet Elbow to Recirculation Valve
Figure 404

aircraft fuel system tube connection.

(a) Apply lubricant E (70-00-01, Servicing and Storage Materials) to new sealing rings and assemble them to the fuel tube end fitment spigot grooves.

(b) Carefully engage fuel tube end fitment spigot with recirculation valve outlet, locate flanged connection on support bracket and retain in position with two bolts and washers lightly tightened.

(c) Assemble clamp to tube and recirculation valve outlet and secure connection with the clamp torque-tightened to between 47 and 57 lbf in. (5,21 and 6,44 N.m).

(d) Torque-tighten bolts securing tube to bracket to between 120 and 144 in. (13,6 and 16,3 N.m)
R and wire-lock them.

(e) Assemble supporting clamp items to tube and secure to pillar bolt with washer and nut torque-tightened to between 100 and 120 lbf in. (11,3 and 13,6 N.m).

(f) Connect, torque-tighten and wire-lock the aircraft system fuel tube and drains system tube to the flanged end fitment of the fuel tube from the recirculation valve outlet. (Ref.71-00-12, Removal/Installation).

E. Check for Leaks at Connections Disturbed During Procedure.

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure - comply with the procedures given in 73-12-01, Adjustment/Test, paragraph 2.

(b) PTIR pressure - comply with the procedures given in 73-12-01, Adjustment/Test, paragraph 3.

(c) On completion of a static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph E.

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of

paragraph F.

R F. Complete the Installation

R (1) On No.1 and No.3 engines, connect the flexible
R hydraulic drain tube to the drains junction block.
R Torque-tighten union nut to between 85 and 95 lbf
R in. (9,6 and 10,7 N.m) with lubricant B applied
R and wire-lock it.

(2) On No.1 and No.3 engines, install support bracket and attach hydraulic tube, clamp blocks and drain block.

(a) Position bracket on engine flange pillar bolts in the position noted during removal and secure with four washers and nuts torque-tightened to between 60 and 70 lbf in. (6,8 and 7,8 N.m).

(b) Position half bushes on the hydraulic tubes with the clamp block halves, locate the fuel re-circulation drain block against the lower clamp block and retain the assembly to the bracket with two bolts and nuts lightly tightened.

(c) Torque-tighten bolts and nuts to between 60 and 70 lbf in. (6,7 and 7,8 N.m).

(3) Install fuel heater exhaust air duct supporting bracket and support strut (Ref. Fig. 403).

(a) Apply lubricant B to attachment items.

(b) Position engine mounted bracket on LP compressor case flange, align attachment holes of bracket ensuring that adjacent bracket attachment hole is also aligned and retain brackets with bolts and nuts lightly tightened.

(c) Secure strut lower end to bracket on LP compressor case flange with bolt, flat washers and nut lightly tightened.

(d) Align attachment holes of strut end fitment and bracket with holes of air duct lug and retain with two bolts lightly tightened.

(e) Torque-tighten nuts securing bracket to LP compressor case flange at positions A and B to

between 67 and 73 lbf in. (7,6 to 8,2 N.m). Torque-tighten nut at position C to between 85 and 95 lbf in. (9,6 to 10,7 N.m).

(f) Torque-tighten nut and bolt securing strut to engine mounted bracket to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(g) Torque-tighten two bolts securing duct to strut and bracket to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(4) Connect and secure the LP compressor front bearing oil feed tube.

(a) Apply lubricant A to LP and HP compressor thrust bearings oil feed tube union nut and union connection at flange assembly. Apply lubricant B to attachment bolts.

(b) Check that the strainer assembly is clean and
R unobstructed. Insert strainer into housing.

(c) Position tube on engine with a gasket placed between tube flange and oil pump. Retain tube flange and electrical cable bracket to oil pump with five bolts lightly tightened. Position the wire-locking bolt as shown.

(d) Connect and screw on the LP and HP compressor thrust bearings oil feed tube union nut hand-tight.

(e) Connect and screw union nut to flange assembly on air intake case.

(f) Attach and secure tube clamp assemblies to support brackets as shown. Torque-tighten bolt securing tube clamp assembly and LP compressor front bearing oil scavenge tube clamp assembly to between 67 and 73 lbf in. (7,6 and 8,2 N.m). Torque-tighten remaining bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

R (g) Torque-tighten tube flange securing bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(h) Torque-tighten LP and HP compressor thrust bearings oil feed tube union nut to between 400 and 440 lbf in. (45 and 49 N.m). Wire-lock union nut to tube flange securing bolt.

(j) Torque-tighten union nut at flange assembly to between 400 and 440 lbf in. (45 and 49 N.m). Wire-lock union nut.

(5) Install the front section of the LP compressor front bearing oil scavenge tube (Ref.72-01-04, para.2).

(6) Connect, tighten and wire-lock electrical lead end plug to recirculation valve.

(7) Secure the electrical harness supporting clamp assemblies to the attachment locations.

(a) Apply lubricant B to attachment bolts and nuts.

(b) Retain clamps at the two locations to the rear of the oil tank and the next three locations forward with bolts and nuts lightly tightened.

(c) Ensure harness is evenly disposed between supporting clamp assemblies and torque-tighten bolt and nuts to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(8) Install flexible fuel drains tube between drains connections of recirculation valve and fuel inlet elbow.

(a) Apply lubricant B and connect tube with union nuts hand-tight.

(b) Torque-tighten nuts to between 85 and 95 lbf in. (9,6 and 10,7 N.m). and wire-lock them.

(9) Connect HE ignition leads and secure in position with supporting clamps (Ref. Fig. 401).

(a) With leads supported, connect lead end nuts
R hand-tight on their respective ignition unit connections.

(b) Apply lubricant B to clamp attachment items and attach clamps to their locations without tightening nuts and bolts.

(c) Torque-tighten lead end union nuts to the following values.

R (c1) On pre S.B.OL.593-74-5 engines: to between 10 and 15 lbf ft (13,6 and 20,3 N.m).

R (c2) On S.B.OL.593-73-5 engines:
to between 20 and 25 lbf ft (27 and 34 N.m).

(d) Wire-lock nuts together.

(e) Ensure that leads are evenly disposed between their support points and torque-tighten clamp attachment nuts and bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(f) Connect, tighten and wire-lock LT supply lead.

(10) With the oil tank full (Ref.12-13-79, Servicing) and the overflow drain connection drain plug installed, add a quantity of oil to the tank equivalent to that drained during removal procedure.

(11) Carry out ignition system test (Ref.74-00-00, Adjustment/Test).

(12) If not already done during a fuel leak check procedure, remove safety clips, reset circuit breakers (Ref.Table 401) and open LP fuel isolation valve.

(13) If a leak check is to be made during an engine run carry out a preliminary leak check using the aircraft fuel feed pumps.

(a) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all air from the system.

(b) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(c) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

(d) On completion of check, switch off the aircraft fuel feed pumps.

(14) To complete the installation and/or prepare for ground run, install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and

wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(15) If a fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing) that are required for the engine run checks, then comply with the procedures of 73-00-00 and 71-00-00, Adjustment/ Test respectively. On completion of engine run retrip circuit breakers and attach safety clips.

(16) Close engine bay doors (Ref.71-00-00, Servicing).

TUBES, FUEL DISTRIBUTION AND DUMP VALVE (SERVO AND SERVO SPILL) - REMOVAL/INSTALLATION

1. General

The fuel tubes, fuel distribution and dump valve (servo and servo spill) are in four sections, servo flow tube from FCU to dump valve on distribution block, servo spill flow tube, in two sections joined by a union connection, from FCU to rear face on distribution block and servo spill flow tube from distribution block rear face to connection on tube flange at flowmeter inlet. The removal and installation procedures applicable to each section are given, in sequence,in paragraphs 3 to 6.

R Details of approved servicing and storage materials quoted in
R this chapter are given in 70-00-01.

2. Tools and Equipment

Circuit breaker safety clips ... ... -

3. Tube - FCU to Distribution and Dump Valve (Servo) (Ref. Fig. 401)

A. Prepare to Remove Tube Section.

R (1) Close the LP fuel isolation valve and ensure that
R the valve indicator shows shut.

(2) Open engine bay doors on engines No.1 and 3 and open lower doors on engines No.2 and 4 (Ref. 71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
	Engine No. 1			
R	LP VALVE SUP 1	15-216	1Q1	C 1
R	LP VALVE SUP 2	16-215	1Q2	-
	Engine No. 2			

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
R	LP VALVE SUP 1	15-216	2Q1	F 2
R	LP VALVE SUP 2	15-215	2Q2	C19
	<u>Engine No. 3</u>			
R	LP VALVE SUP 1	15-216	3Q1	F 1
R	LP VALVE SUP 2	15-215	3Q2	C20
	<u>Engine No. 4</u>			
R	LP VALVE SUP 1	15-216	4Q1	C 2
R	LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 401

(4) On No. 2 and No. 4 engines remove engine flowmeter (Ref.73-33-01, Removal/Installation).

B. Remove Tube.

(1) Remove bolts securing tube flange to FCU (rear face top inner connection).

(2) Remove bolts securing tube flange to distribution and dump valve.

(3) Remove tube from engine.

(4) If a tube is to be renewed, transfer union nut and blanking ferrule to tube to be installed.

(a) Apply lubricant A to union connection, assemble nut and ferrule and torque-tighten nut to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(b) Wire-lock nut.

C. Install Tube.

(1) Apply lubricant A to union connection and clamp assembly attachment items, lubricant B to flange attachment items.

(2) Position tube on engine and assemble tube flanges to
R FCU and distribution and dump valve, interposing
R serviceable seal plates (Ref.70-00-03, Sealing Devi-
R ces) between the tube flanges and the adjacent faces
R of the FCU and distribution and dump valve.

(3) Secure flanges with attachment bolts, torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(4) On No.2 and No. 4 engines install the engine flowmeter (Ref. 73-33-01, Removal/Installation), and complete the installation for all engines as detailed in paragraph 7.

4. Tube, FCU to Union Connection (Servo Spill) (Ref. Fig. 401)

A. Prepare to Remove Tube Section.

(1) Carry out the procedures detailed in paragraph 3.A.

B. Remove Tube.

(1) Remove bolts securing tube flange to FCU (rear face lower connection).

(2) Unscrew union nut at union connection.

(3) Detach supporting clamp assembly from bracket and remove tube from engine.

(4) If tube is to be renewed, transfer clamp assembly to a similar position on the tube to be installed.

C. Install Tube.

(1) Apply lubricant B to union connection, flange attachment items and clamp assembly attachment items.

(2) Position tube on engine, assemble tube flange to
R FCU interposing a serviceable seal plate (Ref.
R 70-00-03, Sealing Devices) between adjacent faces of
R the tube flange and FCU. Retain with attachment
R bolts, lightly tightened.

(3) Engage union connection hand-tight.

(4) Secure clamp assembly to support bracket with bolt, nut and flat washer torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(5) Torque-tighten tube flange attachment bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(6) Torque-tighten union connection to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock nut.

(7) On No. 2 and No. 4 engines install the engine flowmeter (Ref. 73-33-01. Removal/Installation), and complete the installation for all engines as detailed in paragraph 7.

5. Tube, Union Connection to Distribution and Dump Valve Rear Face (Servo Spill) (Ref. Fig. 401)

A. Prepare to Remove Tube Section.

(1) Carry out the procedure detailed in paragraph 3A.

B. Remove Tube.

(1) Unscrew union nut at union connection.

(2) Remove bolts securing tube flange to distribution and dump valve rear face.

(3) Detach supporting clamp assembly and remove tube from engine.

(4) If tube is to be renewed, transfer clamp assembly to a similar position on the tube to be installed.

C. Install Tube.

(1) Apply lubricant A to union connection, lubricant B to flange attachment items and clamp assembly attachment items.

(2) Position tube on engine, assemble tube flange to
R distribution and dump valve interposing a serviceable
R seal plate (Ref.70-00-03, Sealing Devices) between
R adjacent face of tube flange and distribution and
R dump valve. Retain with attachment bolts lightly
R tightened.

(3) Engage union connection hand-tight.

(4) Secure clamp assembly to support bracket with bolt, nut and flat washer torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(5) Torque-tighten tube flange attachment bolts to

FCU TO UNION CONNECTION

A

SEAL PLATE

FCU REAR FACE

B

C

D

A

DISTRIBUTION AND DUMP VALVE

B

FCU TO DISTRIBUTION AND DUMP VALVE

DISTRIBUTION AND DUMP VALVE REAR FACE

BLANKING FERRULE

C

CMR 73 13 10 4 AAM0

FCU TO DISTRIBUTION AND DUMP VALVE

SEAL PLATE

DISTRIBUTION AND DUMP VALVE REAR FACE TO UNION CONNECTION NEAR FLOWMETER INLET

D

SEAL PLATE

UNION CONNECTION TO DISTRIBUTION AND DUMP VALVE REAR FACE

Servo and Servo Spill Tubes and
Location Detail
Figure 401

between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(6) Torque-tighten union connection to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock nut.

(7) On No. 2 and No. 4 engines install the engine flowmeter (Ref. 73-33-01, Removal/Installation), and complete the installation for all engines as detailed in paragraph 7.

6. Tube - Distribution and Dump Valve Rear Face to Union Connection Near Flowmeter Inlet (Servo Spill) (Ref. Fig. 401)

A. Prepare to Remove Tube Section

(1) Open engine bay doors, close LP fuel isolation valve and trip the circuit breakers as detailed in paragraph 3A.

(2) Unscrew tube union nut at connection on FCU to flow-meter fuel tube flange.

(3) On No. 2 and No. 4 engines remove engine flowmeter (Ref. 73-33-01, Removal/Installation).

B. Remove Tube.

(1) Remove bolts securing tube flange to distribution and dump valve rear face.

(2) Detach clamp assembly and remove tube from engine.

(3) If tube is to be renewed, transfer clamp assembly to a similar position on the tube to be installed.

C. Install Tube.

(1) Apply lubricant A to union connection, lubricant B to flange attachment items and clamp assembly attach-ment items.

(2) Position tube on engine, assemble tube flange to
R distribution and dump valve with a serviceable seal
R plate (Ref.70-00-03, Sealing Devices) between
R adjacent faces of tube flange and distribution and
R dump valve. Retain with attachment bolts lightly
R tightened.

(3) Engage union nut at connection on FCU to flowmeter tube flange and hand-tighten.

(4) Secure clamp assembly to support bracket with bolt,
R flat washer and clip nut, torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(5) Torque-tighten tube flange attachment bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(6) On No. 2 and No.4 engines install the engine flowmeter (Ref. 73-33-01, Removal/Installation).

(7) Torque-tighten union connection to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock nut.

(8) Complete the installation as detailed in paragraph 7.

7. <u>Complete the Installation</u>

A. Check for Leaks at Connections Disturbed During Procedure.

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure - remove safety clips, reset circuit breakers (Ref. Table 401), open LP fuel isolation valve and comply with the procedures given in 73-00-00, Adjustment/Test, paragraph 4.

(b) PTIR pressure - comply with the procedures given in 73-00-00, Adjustment/Test, paragraph 5.

(c) On completion of static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph B.

(2) If a leak check is to be carried out during an engine run.

(a) Remove safety clips, reset circuit breakers (Ref. Table 401) and open LP fuel isolation valve.

(b) Reset the circuit breakers, tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing), that are required for the engine run checks.

(c) Comply with the engine run leak check procedures given in 73-00-00, Adjustment/Test paragraph 3.

(d) On completion of engine run, retrip circuit

breakers, which were reset for engine run (Ref. para. (b)), attach safety clips and continue with the installation procedure of paragraph B.

B. Restore Engine to Flight Standard.

(1) If not already done during a fuel leak check procedure, remove safety clips, reset circuit breakers (Ref. Table 401) and open LP fuel isolation valve.

(2) Close engine bay doors (Ref.71-00-00, Servicing).

TUBES, DRAINS TANK RETURN TO FIRST STAGE PUMP/ RECIRCULATION VALVE - REMOVAL/INSTALLATION

1. General

The fuel tube from drains tank to the recirculation valve is in seven sections with union nut connections. Two tube sections connect the ejector pump outlet to the recirculation valve and their Removal/Installation procedures are detailed in paragraph 3. The remaining five sections connect the drains tank to the ejector pump inlet and the Removal/Installation procedures for these sections are detailed in paragraph 4. The tools and equipment are only requred for the two tube sections, ejector pump outlet to recirculation valve.

Details of lubricants quoted in this chapter are given in 70-00-01, Servicing and Storage Materials.

2. Tools and Equipment

Air bleed tube	PE.22898
Drain tube for inlet elbow drain valve	PE.34076
Circuit breaker safety clip...	-

3. Tube - Ejector Pump Outlet to Recirculation Valve (Ref. Fig. 401)

A. Prepare for Tube Removal.

(1) Open engine bay front lower door (Ref.71-00-00, Servicing).

(2) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP Fuel Shut-off Valve	15-216	1Q1	C1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
	1-213	1Q2	J11
R Engine No.2			
LP Fuel Shut-off Valve	15-215 3-213	2Q1 2Q2	C19 A5
Engine No.3			
LP Fuel Shut-off Valve	15-215 3-213	3Q1 3Q2	C20 A6
Engine No.4			
LP Fuel Shut-off Valve	15-216 1-213	4Q1 4Q2	C2 J12

Circuit Breakers
Table 401

(4) Drain the engine fuel system.

(a) Utilize the air bleed valve near the fuel distribution block and fuel inlet drain valve and drain the system.

(b) When fuel drain ceases, remove the drain tool and close the bleed valve leaving the bleed tube in position.

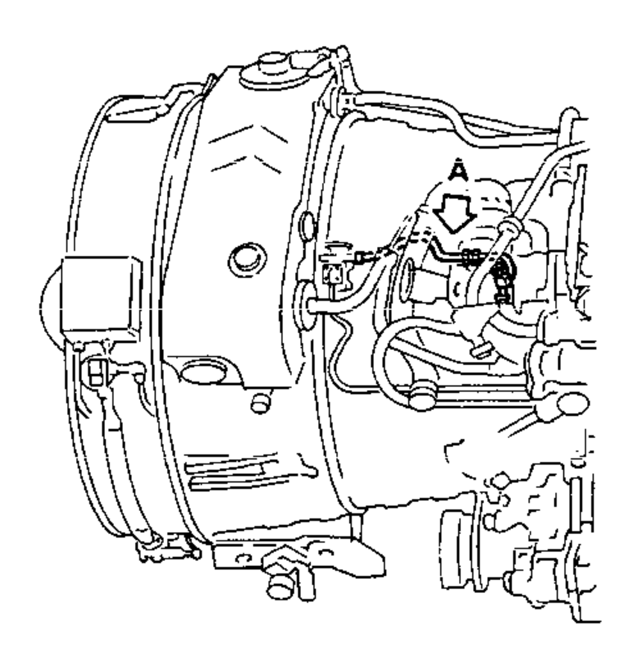
B. Remove Tubes.

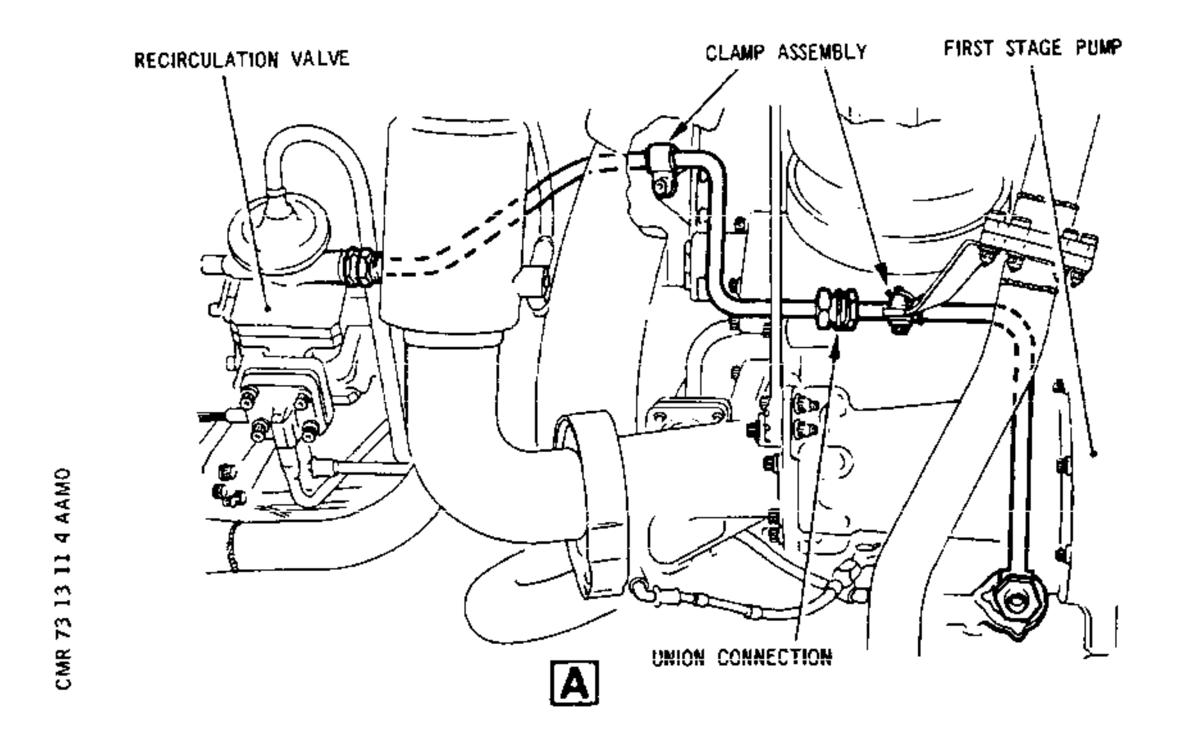
NOTE: If only one tube section is requred to be removed only detach the clamp assembly and union nuts securing that tube section.

R (1) Remove bolt and flat washer securing each clamp
R assembly to support bracket.

(2) Support each tube section in turn, unscrew union nut connections and remove tube section.

(3) If tubes are to be renewed, transfer clamp assemblies to similar positions on the tubes to be installed.





Tube Sections and Location Details
Figure 401

C. Install Tubes.

(1) Apply lubricant A to union connections and clamp assembly bolts and nuts.

(2) Position tube(s) on engine and engage union connections hand-tight.

(3) Secure each clamp assembly to its support bracket with bolt, clipnut and flat washer, torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(4) Torque-tighten union connections to between 190 and 210 lbf in. (21, 5 and 23,7 N.m).

(5) Wire-lock union nuts.

D. Complete the Installation.

(1) Pressure test tube connections between ejector pump outlet and recirculation valve and check for leaks (Ref.73-00-00).

(2) Ensure that the bleed valve is closed and torque-tightened and that the bleed valve and fuel inlet elbow drain valve caps are installed concurrent with the pressure test procedure.

(3) Upon completion of pressure test, remove safety clips and reset the circuit breakers (Ref. Table 401).

(4) Close engine bay doors (Ref.71-00-00, Servicing).

4. <u>Tube - Drains Tank to Ejector Pump Inlet</u>

A. General.

A separate Removal/Installation procedure is given for each tube section. The procedures relating to the first, second and fifth tube sections, starting from the drains
R tank, are detailed in paragraphs B, C and F. The
R procedures for the remaining two sections will be issued
R later in paragraphs D and E. Details of the tube clamp
R assemblies with their attachment items are shown in the
R illustration (Ref. Fig. 402).

B. First Tube Section (Ref. Fig. 402).

(1) Open engine bay rear lower door (Ref.71-00-00, Servicing).

(2) Remove tube section.

(a) Detach tube clamp assemblies shown as detail J and H.

(b) Support tube section, unscrew union nut connections and remove tube section.

(c) If tube section is to be renewed, transfer clamp assemblies to similar positions on the tube section to be installed.

(3) Install tube section.

(a) Apply lubricant A to union connections and clamp assembly nuts and bolts.

(b) Position tube section on engine and engage union connections hand-tight.

(c) Attach clamp assembly, shown as detail J, to pillar bolt at support bracket with distance piece, flat washer and nut lightly tightened.

(d) Attach clamp assembly, shown as detail H, to support bracket with flat washer, nut and bolt lightly tightened.

(e) Torque-tighten nuts and bolts securing clamp assemblies to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(f) Torque-tighten union connections to between 190 and 210 lbf in. (21,5 and 23,7 N.m) and wire-lock them.

(4) Close engine bay doors (Ref.71-00-00, Servicing).

C. Second Tube Section (Ref. Fig. 402).

(1) Open engine bay rear lower door (Ref.71-00-00, Servicing).

(2) Remove tube section.

(a) Detach tube clamp assembly shown as detail G.

R (b) Support tube section, unscrew union nut
R connections and remove tube section.

(c) If tube section is to be renewed, transfer clamp

FIRST STAGE PUMP

C

DRAINS TANK

G

A B D E K F H J

UNION CONNECTIONS

UNION CONNECTIONS

A

B

C

G, H, K SIMILAR

D

E

F

J

CMR 73 13 11 4 BAMO

Tube Sections and Location Details
Figure 402

assembly to similar position on the tube section to be installed.

(3) Install tube section.

(a) Apply lubricant A to union connections and clamp assembly nut and bolt.

(b) Position tube section on engine and engage union connections hand-tight.

(c) Attach clamp assembly to support bracket with flat washer, nut and bolt torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(d) Torque-tighten union connections to between 190 and 210 lbf in. (21,5 and 23,7 N.m) and wire-lock them.

(4) Close engine bay doors (Ref.71-00-00, Servicing).

D. Third Tube Section.

To be issued later.

E. Fourth Tube Section.

To be issued later.

F. Fifth Tube Section (Ref. Fig. 402)

(1) Open engine bay rear lower door (Ref.71-00-00, Servicing).

(2) Remove tube section.

(a) Support tube section, unscrew union nut connections and remove tube section.

(3) Install tube section.

(a) Apply lubricant A to union connections.

(b) Position tube section on engine and engage union connections hand-tight.

(c) Torque-tighten the tube union connection at the ejector pump inlet to between 220 and 240 lbf in. (24,9 and 27,1 N.m).

(d) Torque-tighten union connection at junction

with fourth tube section to be between 190 and 210 lbf in. (21,5 and 23,7 N.m).

(e) Wire-lock both union nuts.

(4) Close engine bay doors (Ref.71-00-00, Servicing).

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TUBES - CONNECTING OIL COOLER TO AIR BLEED VALVE - REMOVAL/INSTALLATION

1. General

The tube is in two sections, oil cooler to union connection and union connection to bleed valve.

2. Tools and Equipment

Circuit breaker safety clip ... ...

3. Tube (Ref. Fig. 401)

A. Prepare to Remove Tube.

(1) To remove lower tube section, open engine bay front doors (Ref.71-00-00, Servicing).

(2) To remove upper tube section on engines No.2 and No.4, remove engine (Ref.71-00-00) and on engines No.1 and No3, open engine bay front doors (Ref.71-00-00, Servicing).

(3) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

(4) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP Fuel Shut-off Valve	15-216	1Q1	C1
	1-213	1Q2	J11
Engine No.2			
LP Fuel Shut-off Valve	15-215	2Q1	C19
	3-213	2Q2	A5
Engine No.3			
LP Fuel Shut-off Valve	15-215	3Q1	C20

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	3-213	3Q2	A6
Engine No.4			
LP Fuel Shut-off Valve	15-216 1-213	4Q1 4Q2	C2 J12

Circuit Breakers
Table 401

4. Tube Section - Union Connection to Bleed Valve

A. Remove Tube.

(1) Carry out the procedure detailed in paragraph 3.A.

(2) Detach dust cap from valve, remove bolts and nuts securing bleed valve to support bracket attached to
R distribution and dump valve/pilot atomizing nozzle
R tube flange.

(3) Unscrew union nut at tube connection and remove tube and bleed valve from engine.

B. Install Tube.

(1) If a new tube is to be installed, unscrew valve assembly and screw in tube to be installed.

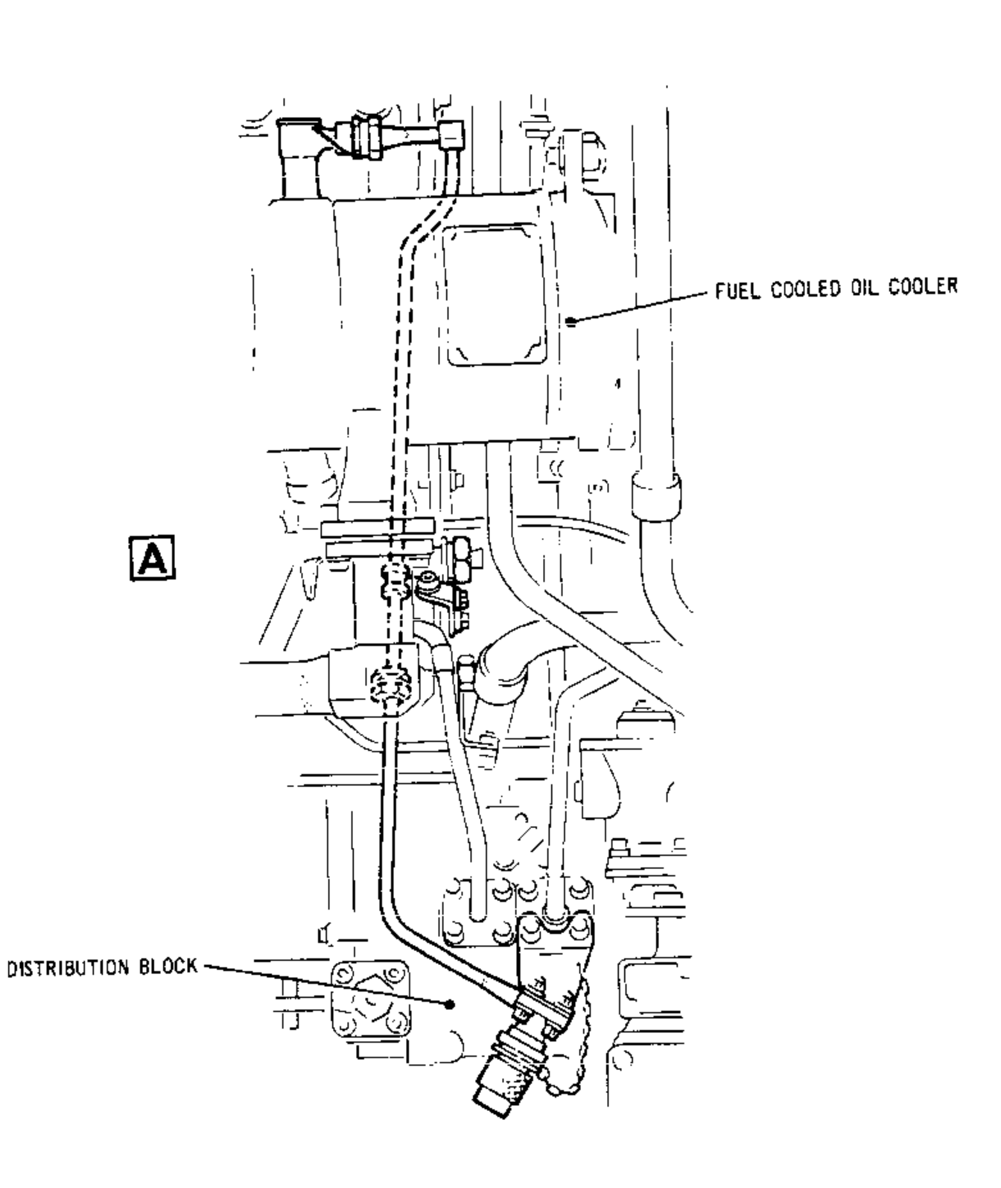
(2) Apply lubricant B (Ref.70-00-01, Servicing and Storage Materials) to bolts, apply lubricant A to union connection.

(3) Assemble tube and secure bleed valve to support bracket with two bolts and nuts.

(4) Screw on union nut at tube connection and torque-tighten to between 190 and 210 lbf in. (21,5 and 23,5 N.m); wire-lock nut.

(5) Torque-tighten bolts and nuts to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(6) Complete installation as detailed in paragraph 6.



Tube Sections and Location Details
Figure 401

R

5. Tube Section - Oil Cooler to Union Connection

A. Remove Tube.

(1) Carry out the procedure detailed in paragraph 3.A.

(2) Unscrew union nut at oil cooler air bleed adapter.

(3) Unscrew union nut at tube connection.

(4) Detach clamp assembly from bracket. Remove tube.

B. Install Tube.

(1) Apply lubricant B to bolt, lubricant A to union connections.

(2) Install tube, screw on union nuts hand-tight.

(3) Torque-tighten union nuts to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock nuts

(4) Assemble clamp assembly to bracket at HP compressor case flange. Torque-tighten bolt and nut to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(5) Complete installation as detailed in paragraph 6.

6. Complete the Installation

A. Install engine No.2 and No.4 if removed for procedure and comply with paragraph B before closing engine bay doors.

B. Pressure test tube connections and check for leaks (Ref.73-00-00). Tighten bleed valve and install dust cap concurrent with pressure test.

C. Close engine bay doors (Ref.71-00-00, Servicing).

TUBES - FUEL HEATER AND FILTER OUTLET TO REHEAT CONTROLLER (SERVO SUPPLY) - REMOVAL/INSTALLATION

1. General

R This tube is in three sections and connects between the fuel heater and filter and the reheat controller. A tube plate forms the tube connection at the heater and filter with union connections at all other positions. The procedure details the removal of the three sections as one sequence. Extract the applicable steps should only one section be for removal and installation.

R Where compliance with a service bulletin has necessitated a change of procedure, it is given in the appropriate sequence.

R Details of lubricants quoted in this topic are given in 70-00-01, Servicing and Storgae Materials.

2. Tools and Equipment

Air bleed tube	PE.22898
Drain tube	PE.34076
Circuit breaker safety clip	-

R 3. Tube - Fuel Heater and Filter to Tube Junction (Ref. Fig.401 and 402)

A. Prepare to Remove Tube Section.

(1) Open engine bay front and rear lower doors (Ref.71-00-00, Servicing).

(2) Close the LP fuel isolation valve of an installed engine and ensure that the valve indicator shows shut.

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.1			
R	LP VALVE SUP 1	15-216	1Q1	C 1
R	LP VALVE SUP 2	16-215	1Q2	-

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.2			
R	LP VALVE SUP 1	15-216	2Q1	F 2
R	LP VALVE SUP 2	15-215	2Q2	C19
	Engine No.3			
R	LP VALVE SUP 1	15-216	3Q1	F 1
R	LP VALVE SUP 2	15-215	3Q2	C20
	Engine No.4			
R	LP VALVE SUP 1	15-216	4Q1	C 2
R	LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 401

(4) Drain engine fuel system.

(a) Utilize the air bleed valve near the fuel distribution and dump valve and the heater and filter drain valve and drain the system.

(b) When fuel drain ceases, remove the drain tool, close the bleed valve and install and wire-lock the pressure cap. Leave the bleed tube in position for the pressure test sequence.

B. Remove Tube Sections.

(1) Unscrew and remove heater air duct spring housing assembly.

R (2) Unscrew union nut from union connection, tube front
R section to tube centre section.
R (3) On engines to pre S.B.OL.593-73-41 standard, remove
R tube front section (Ref. Fig. 401).
R (a) Support fuel heater lower differential pressure
R switch and unscrew attachment bolts.

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SEAL PLATE

FUEL HEATER CONTROL VALVE DIFFERENTIAL PRESSURE SWITCH

A

CLIPNUT

B

FUEL HEATER AND FILTER

REHEAT CONTROLLER

A B C D E F

CMR 73 13 13 4 AAM0

C D E F

Tube Sections and Location Details
(Pre.SB.OL.593-73-41 Standard)
Figure 401

R

CR 34573/00A
SEAL PLATE
BLANKING COVER
CLIPNUT
A
B
FUEL HEATER AND FILTER
REHEAT CONTROLLER
A B C D E F
CMR 73 13 13 4 BAMC
C
D
E
F

Tube Sections and Location Details
(Pre.SB.OL.593-73-41 Standard)
Figure 402

R

(b) Remove switch, seal plates and tube front section.

(4) On engines to S.B.OL.593-73-41 standard, remove tube front section (Ref. fig. 402).

(a) Support blanking cover and tube and unscrew attachment bolts.

(b) Remove blanking cover, seal plates and tube front section.

(5) Unscrew union nut from union connection, tube centre section to tube rear section.

(6) Unscrew union nut from union connection, tube rear section to reheat controller.

(7) Detach supporting clamp assemblies and remove tube centre and rear sections from engine.

C. Install Tube Sections.

(1) Apply lubricant B to attachment items and lubric-cant A to union connections.

R (2) Assemble tube front section to engine (Ref.Fig.401).

R <u>CAUTION</u>: ENSURE ATTACHMENT BOLTS AND THEIR
R CORRESPONDING THREADED HOLES ARE TO
R THE SAME SERVICE BULLETIN STANDARD.

R (a) Ensure assembly pin is secure in the fuel tube
R plate and protrudes from the face that mates
R with the heater.

R (b) On engines to pre S.B.OL.593-73-41 standard
R assemble the differential pressure switch, fuel
R tube and two serviceable seal plates (Ref.
R 70-00-03, Sealing Devices) in preparation for
R installation.

R (b1) Assemble the switch to the fuel tube plate
R with a seal plate between the mating faces
R and hold with the switch assembly pin
R engaged and attachment holes of switch and
R seal and tube plates aligned.

R (b2) Assemble a seal plate to the free face of
R the fuel tube plate with assembly pin

R engaged and attachment holes aligned.

R (b3) Insert two bolts to keep the assembled
R items together.

R (c) On engines to S.B.OL.593-73-41 standard assemble
R the blanking cover, fuel tube and two service-
R able seal plates (Ref.70-00-03, Sealing Devices)
R in preparation for installation.

R (C1) Assemble one seal plate to the fuel tube
R plate face wih the protruding assembly pin
R and hold in position with pin engaged and
R attachment holes of both items aligned.

R (C2) Locate and hold the second seal plate
R against the other fuel tube plate face in
R a position that corresponds with the first
R seal plate. Ensure that the two central
R sealed holes of the seal plates are
R coincident with the holes in the fuel tube
R plate and then position the blanking cover
R against the seal with the attachment holes
R aligned.

R (C3) Insert two bolts to keep the assembled
R items together in the required relative
R positions.

R (d) Position assembled items on heater location with
R fuel tube correctly orientated and assembly pin
R engaged. Retain items in position with the two
R bolts hand tight.

R (e) Screw in the remaining bolts and secure the
R cover and plate with the five bolts torque-
R tightened to between 85 and 95 lbf in. (9,6 and
R 10,7 N.m).

R (3) Assemble tube centre section to engine.

(a) Position tube on engine, engage union nut at front tube section connection hand-tight.

(b) Attach tube with clamp assemblies as shown.

NOTE: Clamp assembly, LP compressor case rear flange, is secured with a bolt and clip nut.

R (4) Assemble tube rear section to engine.

(a) Position tube on engine and engage union nut at centre tube section connection hand-tight.

(b) Engage tube union nut with reheat controller connection hand-tight.

(c) Attach tube with clamp assemblies is shown in the illustration (Ref. Fig. 401).

R (5) Secure tube connections and supporting clamp
R assemblies.

R (a) Torque-tighten union nuts at each tube connection
R to between 190 and 210 lbf in. (21,5 and
R 23,7 N.m). Wire-lock nuts.

R (b) Torque-tighten clamp assembly items to between
R 85 and 95 lbf in. (9,6 and 10,7 N.m).

R D. Complete the Installation.

R (1) Pressure test tube connections and check for leaks
R (Ref.73-00-00). If a leak is disclosed on an
R S.B.OL.593-73-41 standard engine, ensure that the
R seal plate between the blanking cover and the fuel
R tube plate are correctly positioned.

R <u>NOTE</u>: The sealed holes in the seal plate centre must
R be coincident with the fuel transfer ports of
R the fuel tube plate for sealing to be
R effective.

R (2) Assemble and tighten heater air duct spring housing
R assembly.

R (3) Remove safety clips and reset circuit breakers
R listed in Table 401.

R (4) Close engine bay doors (Ref.71-00-00, Servicing).

END OF THIS SECTION

NEXT

FUEL HEATING - DESCRIPTION AND OPERATION

1. General

Each engine has an independent fuel heating system (Ref. Fig. 001) to prevent obstruction of the fuel filter by ice which may form in the fuel. A hot air supply, taken from the engine compressor diffuser case, is used as the heating agent when required.

The engine mounted components (Ref. Fig. 002) consist of a
R fuel heater and filter, a solenoid operated air valve,
R control thermometer and a differential pressure switch
R for the warning system (Ref.73-30-00). A mounting for the
R reheat fuel controller servo supply fuel tube is provided
R below the differential pressure switch, where on early
R standard engines, a second differential pressure switch
R was located. Control switches, amber captions and control
R units for the systems are located in the flight compartment.

2. Fuel Heater and Filter (Ref. Fig. 003)

The fuel heater and filter are housed together in a cylindrical body which is located between the first stage fuel pump and the LP compressor case and attached to the pump outlet flange. Additional support is provided by three links which are attached to the fuel inlet elbow. A header assembly is installed at the upper end of the cylindrical body and a filter cover is retained in position by a bolted lockplate at the lower end.

The body has unevenly spaced holes to ensure the correct positioning of the header while an assembly pin positions the filter cover and its seal plate. Fuel inlet and outlet connections are provided on the body with the fuel inlet connection being supported by a riveted mounting flange on the body. The heater matrix is housed in the upper half of the body and the filter in the lower half. A shroud between the matrix and filter forms a fuel flow guide.

The header assembly is a dome shaped cover with air inlet and outlet connections. An internal baffle plate separates the inlet side of the header from the outlet and abuts a partition bar on the end plate of the matrix.

The matrix assembly consists of U-tubes brazed to an end plate. A partition bar is centrally located on the tube end plate and abuts the baffle in the header. Primary and secondary baffles in the tube assembly form an indirect fuel flow path through the heater, support the assembly and locate

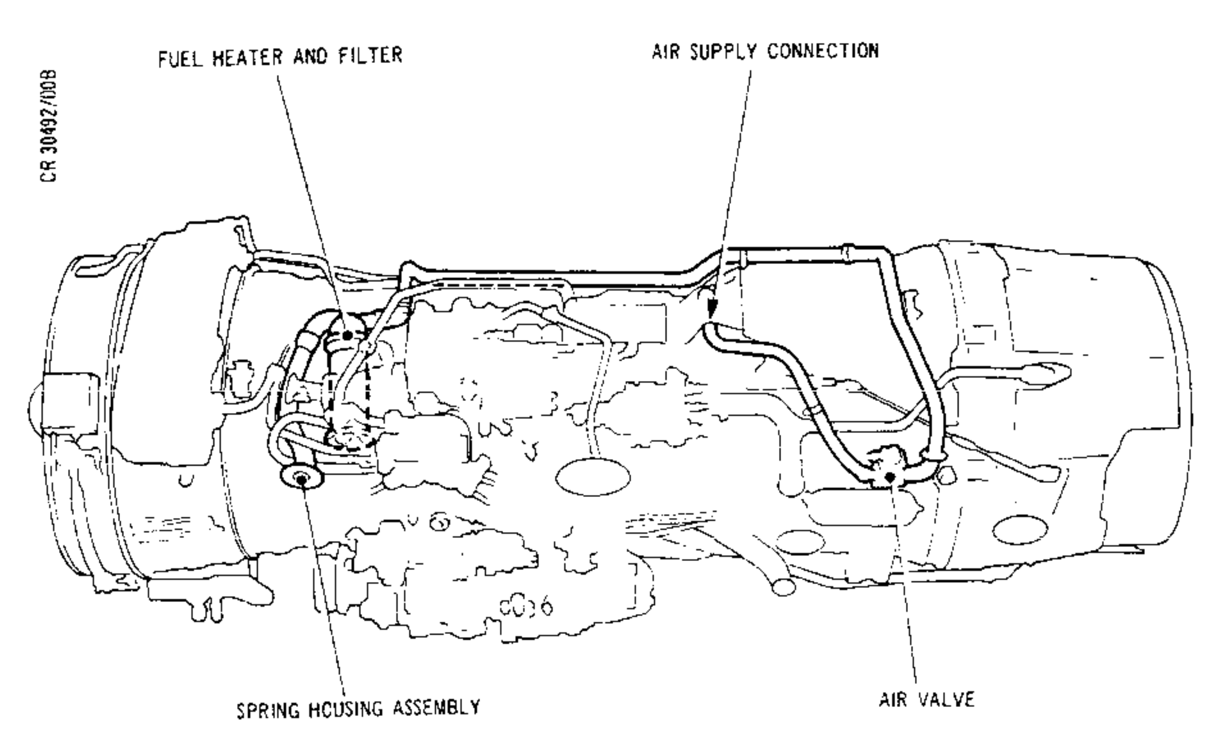
CR 3115I/00B

FUEL FILTER
FUEL HEATERS
ON
AUTO
OFF
CONTROL UNIT
DIFFERENTIAL PRESSURE WARNING SWITCH
FUEL
REHEAT SERVO FUEL (73-13-13)
FUEL HEATER AND FILTER
HEATER CONTROL THERMOMETER
SOLENOID VALVE
S
FUEL
AIR VALVE
AIR
FIRST STAGE FUEL PUMP (73-10-00)
AIR EXHAUST

CMR 73 14 00 0 AAM0

Fuel Heating System Diagram (One Engine)
Figure 001

R



CMR 73 14 00 0 BAM0

Engine Mounted Component Locations
R Figure 002

CR 30420/00C

SECTION THROUGH
SPRING HOUSING ASSEMBLY

FIRST STAGE FUEL PUMP

FUEL DIFFERENTIAL
PRESSURE WARNING SWITCH

SUPPORT LINKS

SPRING HOUSING
ASSEMBLY

AIR OUTLET

AIR INLET

HEATER MATRIX

SEAL PLATE

PRIMARY SEAL

FUEL OUTLET

FUEL INLET

SECONDARY
SEAL

FILTER ELEMENT

SECTION THROUGH
DRAIN VALVE

DRAIN VALVE

CMR 73 14 00 0 CAMO

Fuel Heater and Filter and Differential
Pressure Switch
Figure 003

the matrix within the shell body. Twelve anti-bypass tubes are located between the inner U-tubes. A sealing ring between the body shell and the matrix end plate prevents fuel leakage from the matrix chamber.

The filter has a sealing ring at each end that separates the inlet and outlet regions. Passages from each side of the filter at the inlet and outlet connect with the differential pressure switch and reheat servo fuel supply tube mounted on the side of the body. An integral drain tube, between the pressure switch and fuel tube mountings, connects the internal seal drain passages.

R The filter cover is secured by bolts to the filter body with a
R seal plate positioned between the mating faces. The cover
R has a mounting flange face at its lowest point to provide for
R the attachment of a drain valve assembly.

R The drain valve assembly consists of a body with a bolted
R mounting flange, a hollow spring-loaded valve and a pressure
R cap assembly. The valve is spring-loaded to the closed
R position against a primary seal, a secondary seal within the
R pressure cap effects a seal with the mounting flange when the
R cap is screwed to the body. A drilling in the mounting flange
R connects the space between the seals to the flange seal
R annulus.

R The seal plate assemblies at the fuel system joint faces
R incorporate drain drillings between the primary and secondary
R sealing areas. Any fuel leakage across the primary sealing
R areas is transferred, via drillings in the heater and filter
R unit, to an external fuel drain connection and then via the
R engine seal failure drains system to atmosphere as described
R in 71-73-00.

R The heater is sealed against air leaks by the mating faces of
R the header and body and, by piston type sealing rings, at the
R air inlet and outlet connections.

Hot air enters the fuel heater header and is directed by a baffle to the inlet ends of the U-tube matrix. The air flows through the U-tubes, transfers heat to the colder surrounding fuel, and then passes to exhaust through the header outlet connection. At the same time, fuel enters the fuel heater above the primary baffle and flows from the peripheral annular space inward between the tubes to tbe matrix centre and is then directed down through an opening in the centre of the primary baffle plate to the space between the primary and secondary baffles. A small proportion of the fuel passes through an opening in the centre of the secondary baffle whilst the remainder passes radially outward between the

tubes to peripheral slots in the baffle. The flow through the slots passes inward over the remaining tubes and the conical shroud then directs the fuel, heated by its passage between the tubes, through the filter section to the outlet connection on the body.

3. Fuel Differential Pressure Warning Switch

The differential pressure warning switch is mounted at the upper position on the fuel heater and filter and connects electrically to the indication and master warning system. This switch and its circuit are described in 73-30-00.

4. Fuel Heater Control Thermometer

The control thermometer is located in the first stage fuel pump case and projects into the delivery region of the pump. The thermometer connects electrically to its control unit.

The electrical resistance of the thermometer changes with temperature. When the temperature sensed by the thermometer drops below 5 deg C, the resistance is such that the temperature switch circuit of the control unit is activated.

5. Air Valve (Ref. Fig. 004)

The air valve is of two inch nominal diameter and incorporates a controlling solenoid valve mounted, with its heat shield, on the valve body.

A cylindrical valve body and an air outlet bolt together to form the valve unit and provide flanges at the inlet and outlet ends for connection to the system ducting. A support bracket, secured to the drains tank mounting tube, is bolted to the body inlet flange.

The spring-loaded shut-off head is supported on a carbon bush running on a central spindle in the body and is sealed at the circumference by a triple ring set. A seating for a shut-off head is formed in the air outlet. A control chamber behind the shut-off head is connected by a passage to the solenoid valve and a second passage transmits upstream duct pressure to the solenoid valve.

In the solenoid valve, a spring-loaded armature is opposed by a spring=loaded plunger. The armature and pluger operate a ball between two valve seats to open and close the air passages from the body and a vent passage.

The fuel heater air valve controls the heating airflow in the fuel heating system. The valve is actuated by the ducted

CR 30487/00B

SOLENOID VALVE
FUEL HEATER AIR VALVE
SOLENOID VALVE (DE-ENERGIZED)
VENT
VALVE BODY
SEAT
CONTROL CHAMBER
SHUT-OFF HEAD (CLOSED)
INLET CONNECTION
TRIPLE RING SET
OUTLET CONNECTION
CARBON BUSH

CMR 73 14 00 0 DAMO

SOLENOID ENERGIZED
SOLENOID DE-ENERGIZED

AIR VALVE (OPEN)

AIR VALVE (CLOSED)

Air Valve
Figure 004

R

air pressure and is controlled by the solenoid valve.

When the solenoid is energized the armature is retracted and the ball moves to close the duct pressure passage and, at the same time, open the control chamber to the vent passage. The reduced pressure in the control chamber creates a pressure differential across the shut-off head which then moves back against the spring to open the valve. The valve is held open by the differential pressure and passes heating air until the solenoid is de-energized.

When the solenoid is de-energized the armature extends under spring load and moves the valve to close the vent passage and allow duct pressure to enter the control chamber. The consequent build-up of control chamber pressure, assisted by the spring, holds the shut-off head on its seating and stops the heating airflow.

6. Control Units (Ref. Fig. 005)

The control units for engines No.1 and No.2 are secured in racks 2-215 and 1-215 and those for engine No.3 and No.4 in racks 1-216 and 2-216.

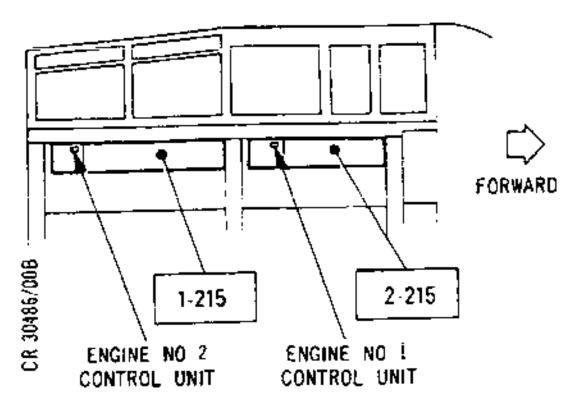
Each unit incorporates two printed circuit boards and a power supply module. A three-position test switch and lamp is located on the front face, while the rear face of the unit embodies a multi-pin connector plug.

When the fuel temperature falls to approximately 5 deg C the heater control thermometer activates the temperature switch of the control unit and an output switch closes to provide a power output to energize the heater air valve solenoid. The pressure switch circuit of the unit is muted and has no control function in this system installation.

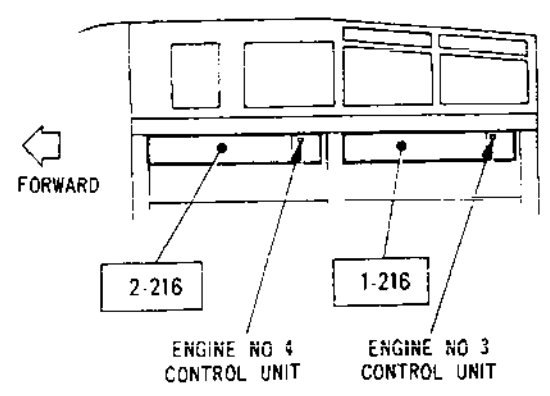
A timer circuit incorporated in the unit latches on when the fuel temperature rises above the datum and maintains the output signal for approximately two and a half minutes. A failure circuit will disconnect the supply in the event of a thermometer open or short circuit fault.

7. Air Tubes and Spring Housing

Air tubes, mounted externally on the engine, are routed from a connection on the compressor diffuser case to an air exhaust at an overboard outlet on the engine bay door via the air valve and heater. The compressor diffuser case connection is located behind the left-hand side engine mounting trunnion. A seal is formed between the outlet end of the exhaust air tube







FLIGHT COMPARTMENT RH ELECTRICAL RACK

TEST SWITCH

TEST LAMP

MULTI-PIN PLUG

CMR 73 14 00 0 LAMO

OUTPUT

TIMER

TEMPERATURE
SWITCH

R Control Unit
Figure 005

and the lower panel of the engine bay rear door by a spring housing (Ref. Fig. 003)

8. Operation of the System

The mode of operation of the fuel heating system for an engine is determined by the OFF, AUTO or ON selection of its respective switch. The locations are as shown in the illustration (Ref. Fig. 006). Selection to AUTO or ON determines whether the air valve is automatically or directly controlled to supply hot air to the heater matrix. The electrical circuit and valve operation are shown in the illustration (Ref. Fig. 007).

An ON selection of the switch takes a supply from the essential Services d.c. busbar to energize the heater air valve solenoid and activate the system irrespective of the fuel temperature.

With AUTO selected on the switch, operation of the system is entirely automatic taking a supply from the main d.c. busbar. The heater air valve will be energized open by the control unit when the fuel temperature, sensed at the first stage fuel pump outlet, drops below 5 deg C. A signal must be present at the control unit in order to maintain an electrical supply to the air valve solenoid. If a signal ceases to actuate the control unit, the timer circuit will prevent solenoid de-energization for appriximately two and a half minutes.

When the solenoid valve is energized, the air valve is opened and the air from the delivery case is directed through the heater matrix to heat the fuel. The air from the heater is then spilled overboard through the spring housing.

Should the pressure difference across the fuel filter at the inlet reach 7 psi, the warning switch will operate and illuminate the amber fuel filter caption light and the master warning caption and single stroke gong.

The test switch on the control unit enables the system to be checked while installed. In the up position the switch by-passes the thermometer and illuminates the warning lamp if the unit has failed in the on condition. In the down position the lamp will be illuminated for a specified period only if the control unit circuitry, the thermometer, and the datum level is satisfactory, and if energization of the solenoid has been achieved.

CR 30489/00A

FUEL FILTER
FUEL FILTER
FUEL FILTER
FUEL FILTER
FUEL HEATERS
ON
AUTO
OFF
ON
AUTO
OFF

PANEL No 1-214

CMR 73 14 00 0 FAMO

Controls and Indicators
Figure 006

CR 38483/00B

DIFFERENTIAL
PRESSURE SWITCH (7 psi)

TO MASTER
WARNING SYSTEM

A FUEL FILTER A

B ESS. 28V
DC BUSBAR

TEMPERATURE
SWITCH

THERMOMETER

TIMER

OUTPUT

B MAIN 28V
DC BUSBAR

CONTROL UNIT

AUTO

ON

OFF

CONTROL SWITCH

AIR VALVE SOLENOID

CMR 73 14 00 0 GAMO

Control and Indication - Schematic
Figure 007

R

FUEL HEATING - ADJUSTMENT/TEST

1. General

The four fuel heater control units, one for each engine system, are located in the LH electrical rack 215 and RH rack 216. Each unit incorporates a system circuit self test facility, located on the front panel, which consists of a test switch and an indicator lamp. Two test procedures are given in paragraph 2, one to be carried out when the fuel ambient temperature is above 20 deg C and the other when it is below 20 deg C.

An audible check procedure for the fuel heater solenoid valve is given in paragraph 3.

2. Fuel Heater and Thermometer Circuit and Power Supply Tests

A. Test Procedure When Fuel Ambient Temperature is Above 20 deg C.

(1) Ensure the heating system circuit breakers are set (Ref.Table 501), switch on the 28 V d.c. supply and select AUTO on the fuel heater control switch, panel 1-214.

(2) Locate the applicable engine system control unit, hold the test switch in the up position and check that the indicator lamp does not illuminate. Return switch to central position.

(3) Hold the test switch in the down position and check that the indicator lamp illuminates.

(4) With the lamp illuminated, return the test switch to the central position and simultaneously start a stopwatch and record the time taken for the lamp to extinguish. The time taken should not be less than 2 min 15s or more than 2 min 45s for a satisfactory test.

(5) Select OFF on the fuel heater control switch and, if no further tests are required, switch off 28V d.c. supply.

(6) If the fuel heater control unit fails to meet the test requirements, refer to 71-00-27, Trouble Shooting.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.1 and 4 FUEL HTR AUTO CONT	15-216	H1331	A11
FUEL HTR IND & MANL CONT	5-213	H1333	B5
Engine No.2 and 3 FUEL HTR AUTO CONT	15-215	H1332	E16
FUEL HTR IND & MANL CONT	1-213	H1334	F8

Circuit Breakers
Table 501

B. Test Procedure When Fuel Ambient Temperature is Below 20 deg C.

(1) Ensure the heating system circuit breakers are set
R (Ref.Table 501), switch on the 28V d.c. supply and
R select AUTO on the fuel heater control switch, panel
R 1-214.

R (2) Locate the applicable engine system control unit
R and check that the indicator lamp has illuminated.
R Hold the test switch in the up position and check
R that the indicator lamp extinguishes. Return the
R switch to central position.

R (3) Select OFF on the fuel heater control switch and
R trip the heating system circuit breakers (Ref.
R Table 501).

R (4) Connect resistor to the fuel heater control ther-
R mometer electrical lead end plug.

R (a) Open engine bay front lower door (Ref.71-00-00,
R Servicing).

R (b) Disconnect electrical lead from fuel heater
R control thermometer.

R (c) Connect a 150 ohms resistor across pins A
R and B of the lead end plug.

(5) Set the heating system circuit breakers (Ref. Table 501) and select AUTO on the fuel heater control switch.

(6) Hold the test switch in the down position and check that the indicator lamp illuminates.

(7) With the lamp illuminated return the test switch to the central position and simultaneously start a stopwatch and record the time taken for the lamp to extinguish. The time taken should not be less than 2 min 15s or more than 2 min 45s for a satisfactory test.

(8) On completion of satisfactory tests, select OFF on the fuel heater control switch, trip the heating system circuit breakers (Ref. Table 501) and carry out the following procedure.

(a) Disconnect resistor from lead end plug.

(b) Connect, tighten and wire-lock lead end plug.

(c) Close engine bay front lower door (Ref. 71-00-00, Servicing).

(9) If no further tests are required, switch off 28 V d.c. supply.

(10) If the fuel heater control unit fails to meet the test requirements, refer to 71-00-27, Trouble Shooting.

3. Fuel Heater Solenoid Valve

A. Prepare to Test.

(1) Open engine bay rear lower door (Ref.71-00-00, Servicing).

(2) Ensure the heating system circuit breakers are set (Ref. Table 501) and that the 28V d.c. supply is switched on.

B. Test Procedure.

(1) Select ON at the fuel heater control switch, panel 1-214. The satisfactory operation of the solenoid valve will be audible to the second operator positioned near the valve.

(2) Return the control switch to the OFF position.

(3) Repeat the procedures detailed in (1) and (2) to ensure a satisfactory test.

C. Complete Test.

(1) Switch off 28V d.c. supply.

(2) Close engine bay rear lower door (Ref.71-00-00, Servicing).

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FUEL HEATER AND FILTER - SERVICING

1. General

R This chapter meets the requirements of Pre S.B.OL.593-73-36
R and 73-36 standard of steady bracket. The requirements for
R fuel heater and filter units of different standards are
R given where applicable.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Extractor assembly, filter element PE.29943

Air bleed tube PE.22898

Drain tube (Pre S.B.OL.593-73-1 drain valve) ... PE.34076

Drain tube (S.B.OL.593-73-1 drain valve) ... PE.26796

Drain tube for heater and filter drain valve ... PE.21970

Circuit breaker safety clip ... ... -

3. Filter Element (Ref. Fig. 301)

R NOTE: Procedures are given for two standards of fuel heater
R and filter unit, Pre.S.B.OL.593-73-37 and 73-37.

A. Prepare to Remove Element.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 301 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LP VALVE SUP 2	16-215	1Q2	-
FUEL HTR AUTO CONT	15-216	H1331	A11
FUEL HTR IND AND MANL CONT	5-213	H1333	B5
<u>Engine No.2</u>			
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19
FUEL HTR AUTO CONT	15-215	H1332	E16
FUEL HTR IND AND MANL CONT	1-213	H1334	F8
<u>Engine No.3</u>			
LP VALVE SUP 1	15-216	3Q1	F1
LP VALVE SUP 2	15-215	3Q2	C20
FUEL HTR AUTO CONT	15-215	H1332	E16
FUEL HTR IND AND MANL CONT	1-213	H1334	F8
<u>Engine No.4</u>			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-
FUEL HTR AUTO CONT	15=216	H1331	A11
FUEL HTR IND AND MANL CONT	5-213	H1333	B5

Circuit Breakers
Table 301

(3) Drain the engine fuel system.

(a) Open bleed valve to expedite draining.

(b) Use drain tube PE.34076 (Pre S.B.OL.593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE.21970 at the fuel heater and filter drain valve. Direct free ends of drain tubes into a container and drain the system upstream of

the FCU.

(c) When fuel drain ceases, remove the drain tubes and close the bleed valve.

NOTE: Discard drained fuel or inhibiting fluid.

R B. Remove Element From Unit to Pre S.B.OL.593-73-37
R Standard (Ref. Fig. 301).

(1) Remove filter steady bracket.

(a) Remove bolts and plate securing steady bracket to bracket at main oil pump flange.

(b) Remove bolts and washers securing steady bracket
R to filter and remove detached bracket and
R locating plate.

(2) Slacken off filter cover unit attachment bolts until clearance is obtained.

(3) Remove filter cover unit.

(a) Support cover unit and turn locking plate to align slot holes with bolt heads.

(b) Continue to support cover unit and withdraw locking plate. Tilt plate sideways to obtain required clearance.

(c) Withdraw cover unit complete with seal plate, tilt unit as necessary to obtain clearance.

(4) Use tool provided and extract element.

R C. Remove Element From Unit to S.B.OL.593-73-37 Standard
(Ref. Fig. 302).

R (1) Remove filter steady bracket.

R (a) Remove bolts and plate securing steady bracket
R to bracket at main oil pump flange.

R (b) Remove bolts and washers securing steady bracket
R to filter and remove detached bracket and
R distance piece.

R (2) Support cover unit and remove remaining bolts
R securing cover to filter unit. Remove cover complete

CR 30477/00A

A

SEALING RING

SEAL PLATE

FILTER ELEMENT

THREAD FOR EXTRACTOR

FILTER COVER UNIT

LOCKING PLATE

MAIN OIL PUMP FLANGE BRACKET

LOCATING PLATE

PLATE

STEADY BRACKET

A

CMR 73 14 01 3 AAMO

Fuel Filter (Pre. S.B.OL.593-73-37 Standard)
Removal/Installation
Figure 301

R

CR 34401/00A

A

SEALING RING

SEAL PLATE

FILTER ELEMENT

THREAD FOR EXTRACTOR

FILTER COVER UNIT

MAIN OIL PUMP FLANGE BRACKET

DISTANCE PIECE

PLATE

STEADY BRACKET

A

CMR 73 14 01 3 BAMO

Fuel Filter (S.B.OL.593-73-37 Standard)
Removal/Installation
Figure 302

with seal plate, tilt as necessary to obtain clearance.

(3) Use tool provided and extract element.

D. Install Element in Unit to Pre S.B. OL.593-73-37 Standard (Ref. Fig. 301).

CAUTION: WHEN ATTACHMENT BOLTS HAVE BEEN REMOVED, ENSURE THAT REPLACED BOLTS AND THEIR CORRESPONDING THREADED HOLES ARE TO THE SAME SERVICE BULLETIN
R STANDARD (REF.S.B.OL.593-73-40).

(1) Assemble new sealing rings to upper and lower grooves of filter element.

(2) Insert filter element into unit, lugged end outward, and press squarely into position.

(3) Assemble a serviceable seal plate (Ref.70-00-03, Sealing Devices) to filter cover unit with assembly pin of cover engaged in locating hole.

(4) Apply lubricant B to attachment bolts and ensure that they are screwed into holes with sufficient protrusion to enable seal plate, cover unit and locking plate to be engaged.

(5) Align cover unit assembly pin to its location and press cover unit and seal plate into position.

(6) Support cover unit, engage locking plate with bolts and turn it until bolt shanks engage small end of slots.

(7) As a further check of compatibility of bolt thread, ensure the locking torque of the bolts is not less than 3.5 lbf in. (0,4 N.m). Lightly tighten bolts to retain mating faces in contact.

(8) Assemble steady bracket and locating plate to cover as shown in the illustration (Ref. Fig. 301) and retain in position with four washers and bolts

(9) As a further check of compatibility of bolt thread, ensure the locking torque of the bolts is not less than 3.5 lbf in. (0,4 N.m). Lightly tighten bolts.

(10) Secure steady bracket to bracket attached to main oil pump flange with plate and two bolts. If necessary, manipulate bracket to align serrations.

(11) Torque-tighten cover unit and bracket attachment bolts to between 80 and 90 lbf in. (9,0 and 10,2 N.m). Ensure that cover unit bolts are evenly tightened in diametral pairs.

E. Install Element in Unit to S.B.OL.593-73-37 Standard (Ref. Fig. 302).

CAUTION: ENSURE ATTACHMENT BOLTS AND THEIR CORRESPONDING THREADED HOLES ARE TO THE SAME SERVICE BULLETIN STANDARD (REF.S.B.OL.593-73-40). R

(1) Assemble new sealing rings to upper and lower grooves of filter element.

(2) Insert Filter element into unit, lugged end outward, and press squarely into position.

(3) Assemble a serviceable seal plate (Ref. 70-00-03, Sealing Devices) to filter cover unit with assembly pin of cover engaged in locating hole.

(4) Apply lubricant B to attachment bolts.

(5) Align cover unit assembly pin to its location and press cover unit and seal plate into position. Support cover unit and engage eight short attachment bolts in their respective positions.

(6) As a further check of compatibility of bolt thread, ensure the locking torque of the bolts is not less than 3.5 lbf in. (0,4 N.m). Lightly tighten bolts.

(7) Assemble steady bracket and distance piece to cover as shown in the illustration (Ref. Fig. 302) and retain in position with four washers and four long attachment bolts.

(8) As a further check of compatability of bolt thread, ensure the locking torque of the bolts is not less than 3.5 lbf in. (0,4 N.m). Lightly tighten bolts.

(9) Secure steady bracket to bracket attached to main oil pump flange with plate and two bolts. If necessary, manipulate bracket to align serrations.

(10) Torque-tighten cover unit and bracket attachment bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m). Ensure that cover unit bolts are evenly tightened in diametrical pairs.

R F. Check for Leaks at Connections Disturbed During Procedure

(1) Disconnect seal failure drains system tubes at fuel heater and filter connection to provide a more precise check for leaks.

(2) Remove safety clips, reset circuit breakers (Ref. Table 301) and open LP fuel isolation valve.

(3) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all air from the system.

(a) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(b) Check for signs of leakage at bleed valve, drain valves and the drains outlets of the engine connections under test. No leaks are acceptable.

<u>NOTE</u>: The seal drains connection at the heater and filter unit is interconnected internally to more than one seal.

(c) On completion of check, switch off the aircraft fuel feed pumps.

(4) If a seal failure drains connection leakage should occur.

(a) Refer to 73-14-01, Adjustment/Test, Fig.501 to identify defective seal(s).

(b) Renew a defective seal or component and then repeat the pressure test and leak check.

G. Complete the Installation.

(1) Connect seal failure drains system tubes at fuel heater and filter connection.

(a) Apply lubricant A to union connections.

(b) Connect seal failure drains system tubes to multiple connector/fluid passage bolt at heater and filter connection.

(c) Triple torque-tighten thrust wire type union nuts (Ref.70-00-04, Torque Loading Data) to

between 90 and 100 lbf in. (10,2 and 11,3 N.m).

(2) Install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valves. Tighten and wire-lock each cap.

(3) Close engine bay doors (Ref.71-00-00, Servicing).

FUEL HEATER AND FILTER - REMOVAL/INSTALLATION

1. General

The removal and istallation of the heater and filter unit given in paragraph 3 is carried out after removal of the first stage pump. The pump removal and installation procedure, detailed in 73-11-01, requires the installation of a support for the heater and filter unit before removal of the pump. The procedures relating to the drain valve and pressure cap are given on paragraph 4.

The heater and filter unit, weight 46 lb. (21 kg), is withdrawn downwards from the engine with the aid of lifting equipment.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Lifting equipment assembly comprising:

Support fixture	PE.35642
Lifting tube	PE.35647
Lifting bracket	PE.35634

3. Heater and Filter

A. Remove First Stage Pump (Ref. 73-11-01, Removal/ Installation).

B. Remove Heater and Filter (Ref. Fig. 401).

(1) Detach seal failure drains system.

(a) Disconnect and remove flexible drain tube from multiple connector at heater and filter unit connection and disconnect flexible drain tube from fluid passage bolt.

(b) Remove fluid passage bolt from heater and filter fuel outlet tube at tube junction.

(2) Remove fuel tube section, heater and filter outlet to tube connection.

(a) Remove bolts securing tube flange to heater and filter unit.

CR 31539/00B

FUEL HEATER AND FILTER

A

LP COMPRESSOR CASE FLANGE

FIRST STAGE PUMP TO RECIRCULATION VALVE FUEL TUBE

FUEL OUTLET TUBE

A

SEALS DRAIN TUBE

FUEL HEATER AND FILTER DRAINS CONNECTION

FLUID PASSAGE BOLT

CMR 73 14 01 4 AAMO

Heater and Filter Unit Location Details
Figure 401

(b) Support tube section, remove nuts and bolts securing tube junction and remove tube. Note location of flange mounted bracket.

(3) Detach drains tank to first stage pump/recirculation valve fuel tube from recirculation valve connection and remove tube section.

(4) Remove heater and filter steady bracket.

(a) Remove bolts and plate securing filter steady bracket to bracket mounted on main oil pump.

(b) Support steady bracket and remove securing bolts and washers at heater and filter unit.

(c) On engines to pre S.B.OL.593-73-37 standard (Ref. Fig. 402), remove bracket and locating plate.

(d) On engines to S.B.OL.593-73-37 standard (Ref. Fig. 403), remove bracket and distance piece.

(5) Disconnect servo tube, heater and filter unit to reheat control unit at tube union connection nearest heater and filter unit.

(6) On engines to pre S.B.OL.593-73-41 standard (Ref. Fig. 402), remove differential pressure switches from heater and filter unit.

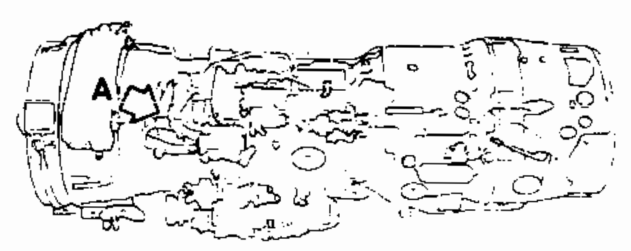
(a) Remove attachment bolts and seal plate from the fuel differential pressure warning switch at upper location. Support weight of detached switch and avoid strain on switch lead.

(b) Remove attachment bolts from lower differential pressure sitch and remove seal plates and servo tube front section. Support weight of detached switch and avoid strain on switch lead.

(7) On engines to S.B.OL.593=73=41 standard (Ref. Fig. 403) remove fuel differential pressure warning switch and blanking cover from heater and filter unit.

R B NOTE: Until all engines are modified fully, ref.
R B S.B.OL.593-73-41 (Deletion of lower Pressure
R B Switch), a situation will arise when the
R B engine loom cannon plug and wiring will have

CR 31078 00A



FUEL DIFFERENTIAL PRESSURE SWITCHES

SEAL PLATES

SUPPORT STRUT

LEFT-HAND GEARBOX

FUEL SERVO TUBE

LOCATING PLATE

STEADY BRACKET

A

CMR 73 14 01 4 BAMO

VIEW IN DIRECTION OF ARROW WITH SUPPORT FIXTURE REMOVED

SUPPORT FIXTURE

MAIN OIL PUMP

Pressure Switches/Filter to Oil Pump Bracket
(Pre. S.B.OL.593-73-37 and 73-41 Standard)
Figure 402

CR 34565/OUA

A

FUEL DIFFERENTIAL
PRESSURE SWITCH

SEAL PLATES

SUPPORT
STRUT

BLANKING COVER

LEFT-HAND
GEARBOX

FUEL SERVO
TUBE

DISTANCE PIECE

STEADY BRACKET

A

VIEW IN DIRECTION OF ARROW
WITH SUPPORT FIXTURE REMOVED

SUPPORT FIXTURE

MAIN OIL PUMP

CMR 73 14 01 4 CAFO

Switch, Cover and Filter to Oil Pump Bracket
(S.B.OL.593-73-37/-41 Standard)
Figure 403

R B been removed but the pressure switch is still
R B fitted to the engine.

(a) Remove attachment bolts and seal plate from differential pressure switch. Support weight of detached switch and avoid strain on switch lead.

(b) Remove attachment bolts from blanking cover and remove cover, seal plates and servo tube front section.

(8) Install lifting equipment (Ref. Fig. 404).

(a) Locate support fixture into angled slot of engine rear mounted bracket and insert it until front section of arm can be located in slot of forward bracket. Lock assembly in place with quick release pin.

(b) Locate rigid end of lifting tube at rear of support fixture slot and press in to completely engage.

(c) Pass mini-hoist cable through lifting tube. Withdraw sufficient cable to locate nipple in lifting bracket.

(d) Position lifting bracket, together with cable on heater and filter unit and secure it at both locations with the nut and bolt.

(e) Engage mini-hoist in flexible end of lifting tube and take weight of heater and filter.

(9) With weight of unit supported by lifting equipment remove support tools.

(a) Remove strut.

(a1) Note position of bolt in slot at upper end of strut.

(a2) Remove bolt and washer from upper end of slot.

(a3) Remove quick removal pin from strut lower end and remove strut and bush.

(b) Remove support fixture.

(b1) Turn handscrew clockwise and retract support block until fully clear of filter drain unit.

(b2) Disengage location pins and remove support fixture.

(10) Slide lifting tube forward in lifting equipment support fixture slot and disengage heater header from duct seal carrier.

(11) Operate the lifting equipment to lower the unit away from engine.

CAUTION: GUIDE UNIT PAST TUBES AND FITTINGS RETAINED ON ENGINE AND ENSURE CLEARANCE DURING REMOVAL PROCEDURES.

(12) Detach lifting bracket from heater and filter unit.

(13) If a replacement heater and filter unit is to be installed, prepare the removed unit for despatch to the overhaul facility.

(a) Note the installed position of the seal drains multiple connector in order that it can be similarly positioned on the replacement unit.

(b) Remove the fluid passage bolt securing the multiple connector, then detach the connector and sealing washers from the unit.

(c) From the base of the replacement heater and filter unit, remove four bolts and flat washers installed at locations to which the steady bracket is to be secured. Assemble the bolts and flat washers to corresponding locations of the removed unit.

(d) Temporarily assemble the two short support links and the long support link, together with all associated items removed in 73-11-01, to the removed unit as shown in the illustration (Ref. Fig.405).

R (e) If the fuel heater and filter units are not to
R be re-installed within 48 hours they must be
R inhibited in accordance with the instructions
R detailed in the manufacturers Component
R Overhaul Manual (73-14-01).

LIFTING EQUIPMENT SUPPORT FIXTURE

REAR BRACKET

LIFTING TUBE

LIFTING BRACKET

LEFT HAND GEARBOX

A

MINI HOIST

CR 31543/00B

CMR 73 14 01 4 CAMO

Lifting Equipment Attachment Details
Figure 404

R

C. Install Heater and Filter Unit.

CAUTION: ENSURE COMPATABILITY OF BOLTS AND MATING THREADS (REF. S.B.OL.593-73-40 AND 73-41).

(1) Prepare a new unit for installation.

(a) Install seal drains adapter.

(a1) Apply lubricant A to attachment items.

(a2) With a new sealing washer each side of the multiple connector secure to heater and filter unit with fluid passage pillar bolt. Position connector as noted before removal.

(a3) Torque tighten fluid passage bolt to

CR 34214/00B

HEADED BUSH
SHIMS
SHIMS
A
SUPPORT LINK
SHIMS
FLAT WASHER
HEADED BUSH

RED CAP/AIR INLET

HEADED BUSH
SHIMS
SUPPORT LINK
B
LOCK PLATE
FLAT WASHER
ECCENTRIC BUSH

CMR 73 14 01 4 DAMO

RED CAP/AIR OUTLET
PRESSURE SWITCH LOCATION BLANKING COVER
FUEL SERVO TUBE LOCATION BLANKING COVER
B
C
A
D

HEADED BUSH
SUPPORT LINK
D
HEADED BUSH
SHIMS
FLAT WASHER

FUEL OUTLET BLANKING COVER

C
FUEL INLET BLANKING COVER

Details of Fuel Heater and Filter Prior to Despatch
Figure 405

between 150 and 170 lbf in. (17 and 19,2 N.m).

(b) Remove the two short support links and the long support link from the unit (Ref.Fig.405). Detach all shims and bushes from the links in readiness for installation of the first stage fuel pump.

(c) Remove transportation blank from fuel outlet port and verify that filter is installed. Temporarily reassemble blank.

(2) Check fuel heater header bolts for incorrect seating.

(a) On Pre S.B. OL.593-73-38 standard of heater and filter unit, use a 0.0015 in. (0,038 mm) feeler gauge and check for incorrect seating of heads of bolts securing fuel heater header to the heater body.

(b) Carry out the requirements of S.B. OL.593-73-38 at locations where the feeler gauge check has indicated incorrect seating.

(3) Attach lifting equipment.

(a) Ensure that support fixture is secure in engine mounted brackets, that lifting tube is fully installed in the front of support fixture slot and that mini-hoist cable is threaded through tube.

(b) Secure lifting bracket, together with attached cable, to heater and filter assembly at both locations with the nut and bolt.

(c) Ensure that mini-hoist is securely attached to lifting tube.

(4) Ensure that heater and filter air inlet seal ring carrier is secure in its elbow location and that sealing ring is serviceable.

R B (5) Operate lifting equipment.

R B (a) Raise unit to mounting position, slide lifting
R B tube rearwards in support fixture slot and
R B engage heater header inlet duct with seal
R B carrier.

R B (b) Ensure the heater header inlet duct has engaged correctly with the seal carrier.

R B (c) Visually examine the adjacent elbow connection for satisfactory alignment of heater header inlet and supply pipeline. Check that the supply pipe is positively secured within the elbow by the retaining plate assembly.

CAUTION: GUIDE ASSEMBLY PAST TUBES AND FITTINGS RETAINED ON ENGINE AND ENSURE CLEARANCE DURING LIFTING PROCEDURES.

(6) Support heater and filter.

(a) Install support fixture.

(a1) Turn handscrew and bring support block to retracted position.

(a2) Engage two location pins at front of support with holes in air outlet duct assembly support bracket, then engage support rear location pin with hole in gearbox mounted bracket.

(a3) Adjust handscrew until support block engages filter drain valve flange and holds assembly securely.

(b) Continue to support heater and filter and install support strut.

(b1) Engage strut bush with support strut location on heater.

(b2) Assemble slotted end of strut on bush. Engage fork end of strut with LP compressor casing flange and secure with quick release pin.

(b3) Assemble washer to bush end shoulder and secure strut fork end with waisted bolt.

(c) Adjust support tool to bring heater and filter unit to its original position noted previously by the position of the bolt in slot at upper end of strut.

(7) Remove lifting equipment.

(a) Detach lifting equipment from heater and filter assembly.

(b) Wind in cable and remove mini-hoist.

(c) Disengage and remove lifting tube assembly from support fixture.

(d) Disengage quick release pin and remove support from engine mounted brackets.

(8) Install fuel differential pressure warning switch on heater and filter unit (Ref. Fig.402).

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CAUTION: ENSURE ATTACHMENT BOLTS AND THEIR CORRESPONDING THREADED HOLES ARE TO THE SAME SERVICE BULLETIN STANDARD.

(a) Apply lubricant B to attachment bolts.

(b) Assemble a serviceable seal plate (Ref.70-00-03, Sealing Devices) to pressure switc with assembly pin engaged and attachment holes aligned.

(c) Locate switch and seal plate on upper location of fuel heater unit. Secure with five shorter bolts lightly tightened.

(d) Torque-tighten attachment bolts for both switches to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(9) On engines to pre S.B.OL.593-73-41 standard, install fuel heater control valve differential pressure switch/fuel servo tube front section on heater and filter unit (Ref. Fig. 402).

CAUTION: ENSURE ATTACHMENT BOLTS AND THEIR CORRESPONDING THREADED HOLES ARE TO THE SAME SERVICE BULLETIN STANDARD.

R B NOTE: Until all engines are modified fully Ref,
R B S.B.OL.593-73-41 (Deletion of Lower Pressure
R B Switch), a situation will arise when the
R B engine loom cannon plug and wiring will have
R B been removed but the pressure switch is still
R B fitted to the engine.

(a) Apply lubricant B to attachment items and lubricant A to union connection.

(b) Ensure assembly pin is secure in the fuel tube plate and protrudes from the face that mates with the heater.

(c) Assemble the differential pressure switch, fuel tube and two serviceable seal plates (Ref. 70-00-03, Sealing Devices) in preparation for installation.

(c1) Assemble the switch to the fuel tube plate with a seal plate between the mating faces and hold with the switch assembly pin engaged and attachment holes of switch and seal and tube plates aligned.

(c2) Assemble a seal plate to the free face of the fuel tube plate with assembly pin engaged and attachment holes aligned.

(c3) Insert two bolts to keep the assembled items together.

(d) Position assembled items on heater location with fuel tube correctly orientated and assembly pin engaged. Retain items in position with two of the longer bolts hand tight.

(e) Screw in the remaining bolts and secure the switch and plate with the five bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(f) Connect and torque-tighten union nut of fuel tube front section to between 190 and 210 lbf in. (21,5 and 23,5 N.m) and wire-lock it.

(10) On engines to S.B.OL.593-73-41 standard (Ref. Fig. 404), install blanking cover/fuel servo tube front section on heater and filter unit.

<u>CAUTION:</u> ENSURE ATTACHMENT BOLTS AND THEIR CORRESPONDING THREADED HOLES ARE TO THE SAME SERVICE BULLETIN STANDARD.

(a) Apply lubricant B to attachment items and lubricant A to union connection.

(b) Ensure assembly pin is secure in the fuel tube plate and protrudes from the face that mates with the heater.

(c) Assemble the blanking cover, fuel tube and two serviceable seal plates (Ref.70-00-03, Sealing Devices) in preparation for installation.

(c1) Assemble one seal plate to the fuel tube plate face with the protruding assembly pin and hold in position with pin engaged and attachment holes of both items aligned.

(c2) Locate and hold the second seal plate against the other fuel tube plate face in a position that corresponds with the first seal plate. Ensure that the two central sealed holes of the seal plates are

coincident with the holes in the fuel tube plate and then position the blanking cover against the seal with the attachment holes aligned.

(c3) Insert two bolts to keep the assembled items together in the required relative positions.

(d) Position assembled items on heater location with fuel tube correctly orientated and assembly pin engaged. Retain items in position with the two bolts hand tight.

(e) Screw in the remaning bolts and secure the cover and plate with the five bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(f) Connect and torque-tighten union nut of fuel tube front section to between 190 and 210 lbf in. (21,5 and 23,5 N.m) and wire-lock it.

(11) Install drains tank to first stage pump/recirculation valve fuel tube section at recirculation valve.

(a) Apply lubricant A to attachment items.

(b) Attach tube section to recirculation valve connection and lightly tighten union nut.

(c) Assemble clamp to tube and secure with bolt, flat washer and clip nut to bracket at LP compressor flange.

(d) Torque-tighten bolt at bracket to between 85 and 95 lbf in. (9,6 and 10,7 N.m) and union nut to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock union nut.

(12) Install heater and filter steady bracket.

CAUTION: ENSURE ATTACHMENT BOLTS AND THEIR CORRESPONDING THREADED HOLES ARE TO THE SAME SERVICE BULLETIN STANDARD.

(a) Apply lubricant B to attachment bolts.

(b) On engines to pre S.B.OL.593-73-37 standard (Ref. Fig. 402), assemble bracket and locating

plate to heater and filter and secure with four bolts and washers lightly tightened.

(c) On engines to S.B.OL.593-73-37 standard (Ref. Fig. 403), assemble bracket and distance piece to heater and filter and secure with four bolts and washers lightly tightened.

(d) Secure steady bracket, together with plate, to bracket on main oil pump, with two bolts lightly tightened.

NOTE: If bracket serrations do not align, loosen bracket retaining bolts, manipulate bracket until serrations align.

(e) Torque-tighten bolts to between 85 and 95 lbf in. (9 and 10,2 N.m).

(13) Install fuel tube section, heater and filter outlet to tube joint.

(a) Apply lubricant B to attachment items.

(b) Support tube in position, insert serviceable seal plate between tube flange and heater and filter faces and secure tube to outlet with four bolts lightly tightened.

(c) Ensure that tube joint faces are in alignment, insert serviceable seal plate. Position tube support bracket to junction flange, as noted during removal, then assemble four bolts and nuts to secure bracket and junction.

(d) Torque-tighten tube flange to heater and filter attachment bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(e) Torque-tighten tube flange joint bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

D. Install the First Stage Pump.

(1) Install the first stage pump as detailed in 73-11-01, Removal/Installation and carry out the leak check in conjunction with that for the heater and filter unit.

E. Check for Leaks at Connections on First Stage Pump/Heater and Filter Unit Disturbed During Procedure.

(1) If a static pressure test for leaks is to be carried out.

(a) Use either the aircraft fuel feed pumps or the PTIR in conjunction with the procedures given in 73-14-01, Adjustment/Test.

(b) On completion of static pressure test and removal of any installed test equipment, complete the installation procedure of the heater and filter unit given in paragraph F, then continue with the procedures for the first stage pump given in 73-11-01, Removal/Installation.

(2) If a leak check is to be carried out during an engine run, complete the installation procedure of the heater and filter unit given in paragraph F, then continue with the procedures for the first stage pump given in 73-11-01, Removal/Installation.

F. Complete the Installation.

(1) Apply lubricant A to attachment items.

(2) Connect seal failure drains system to heater and filter outlet tube connection.

(a) Assemble a new seal washer to each side of the connector and secure in position with the fluid passage bolt torque-tightened to between 150 and 170 lbf in. (17 and 19,2 N.m).

(b) Wire-lock fluid passage bolt.

(3) Connect seal failure drains system tubes to heater and filter unit.

(a) Secure drain tubes to fluid passage bolt and multiple connector.

(b) Triple torque-tighten thrust wire type union nuts (Ref.70-00-04, Torque-Tightening Technique) to between 90 and 100 lbf in. (10,2 and 11,3 N.m).

(c) Wire-lock both union nuts.

4. <u>Drain Valve and Pressure Cap</u>

A. General.

The drain valve is located at the bottom of the assembly on the filter cover unit. Removal and disassembly is necessary when a valve seal is to be renewed.

B. Tools and Equipment.

Air bleed tube	PE.22898
Drain tube (Pre S.B.OL.593-73-1 drain valve)	PE.34076
Drain tube (S.B.OL.593-73-1 drain valve) ...	PE.26796
Circuit breaker safety clip	-

C. Prepare to Remove Drain Valve.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front lower doors (Ref.71-00-00, (Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C 1
LP VALVE SUP 2	16-215	1Q2	-
Engine No.2			
LP VALVE SUP 1	15-216	2Q1	F 2
LP VALVE SUP 2	15-215	2Q2	C19
Engine No.3			
LP VALVE SUP 1	15-216	3Q1	F 1
LP VALVE SUP 2	15-215	3Q2	C20
Engine No.4			
LP VALVE SUP 1	15-216	4Q1	C 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 401

(4) Drain inlet section of engine fuel system.

(a) Open bleed valve to expedite draining.

(b) Use drain tube PE.34076 (Pre S.B. OL.593-73-1 drain valve) or PE.26796 (S.B. OL.593-73-1 drain valve) at the inlet elbow drain valve and drain the system upstream of the fuel heater and filter.

(c) When fuel drain ceases, remove the drain tube and close the bleed valve.

NOTE: Discard drained fuel or inhibiting fluid.

D. Remove Drain Valve.

(1) Release valve cap locking wire.

(2) Unscrew valve attachment bolts and remove the valve complete with its pressure cap and the seal plate.

E. Dismantle Drain Valve.

(1) Unscrew the pressure cap from the valve flange body and extract the sealing ring.

(2) Disassemble valve unit.

(a) Unscrew the valve body from the flange body. Take care that spring and valve are not dropped and remove spring.

(b) Withdraw the valve from the flange body.

(c) Remove the sealing ring from the valve.

F. Assemble Drain Valve.

(1) Assemble valve unit.

(a) Assemble a new sealing ring to the valve and insert it in the flange body.

(b) Position the spring on the valve and retain with the valve body screwed on the flange body. Tighten valve body to 100 lbf in.

(2) Assemble a new sealing ring to the pressure cap and screw onto flange body.

G. Install Drain Valve.

CAUTION: ENSURE COMPATIBILITY OF BOLTS AND MATING THREADS (REF. S.B.OL.593-73-40).

(1) Assemble a serviceable seal plate to the drain valve mating face.

(2) Locate assembly on filter cover unit and align attachment holes.

(3) With lubricant A applied, insert the four attachment bolts with a locking wire washer under one bolthead and the pressure cap lanyard washer under another.

(4) Torque-tighten the bolts to 100 lbf in. (11,25 Nm).

H. Complete the Installation.

(1) Carry out a leak check of the drain valve with pressure cap removed (Ref.73-00-00, Adjustment/Test). Reset circuit breakers (Ref. Table 401) and install bleed and drain valve pressure caps concurrently with the pressure test.

(2) Close engine bay doors (Ref.71-00-00, Servicing).

CR 34923/00A

A

VALVE BODY

A

VALVE

SEAL PLATE

SEALING RING

DRAIN VALVE
ASSEMBLY

FLANGE BODY

B

B

SEALING RING

PRESSURE CAP

CMR 73 14 01 4 EAMO

Drain Valve and Sealing Rings
Figure 406

FUEL HEATER AND FILTER - ADJUSTMENT/TEST

1. General

This procedure is complementary to the Removal/Installation of the fuel heater and filter unit, and details the procedures for a static pressure test to be carried out concurrent with the pressure test and leak check of the first stage fuel pump which was removed for access.

2. Pressure Test and Leak Check Fuel Heater and Filter

A. Prepare for Leak Check.

(1) Ensure that connections at drains to be leak checked are detached (Ref.73-14-01, Removal/Installation).

(a) Seal drain tubes at heater and filter unit connection.

(b) Seal drain tubes at heater and filter fuel outlet tube junction.

B. Apply Static Pressure and Check for Leaks.

(1) Carry out a pressure test and leak check of first stage fuel pump as detailed in 73-11-01 Adjustment/Test and check concurrently for signs of leakage at the heater and filter unit and fuel tube junction. No leaks are acceptable.

(2) If a seal failure drains connection should show any leakage:

(a) Remove pressure cap from drain valve and check that leak does not originate from the valve internal sealing ring.

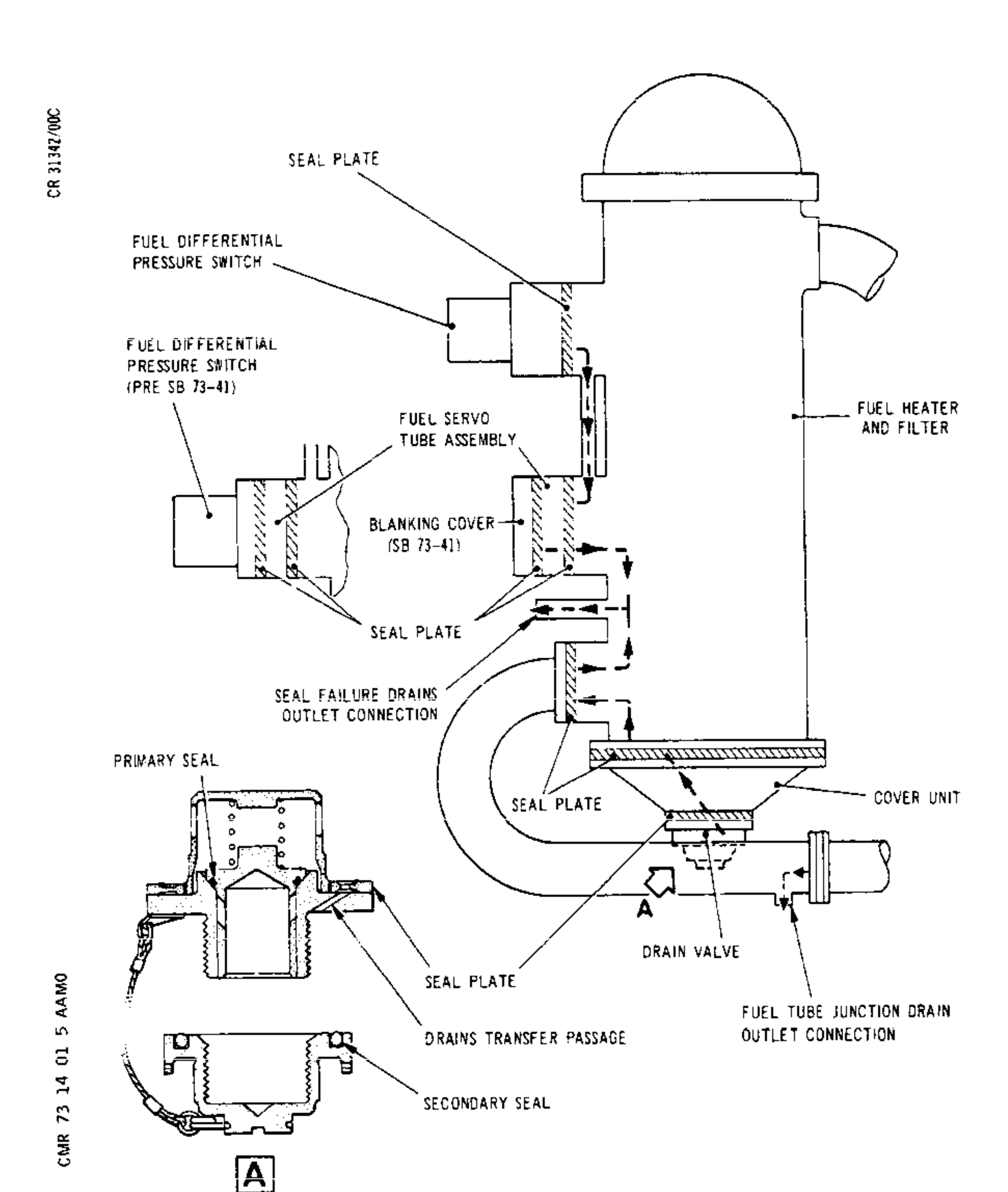
(b) Establish the location of a possible defective seal at any other position by reference to
R (Ref. Fig. 501)

R NOTE: If a leak is disclosed on an S.B.OL.
R 593-73-41 standard engine, ensure that
R the seal plate between the blanking
R cover and the fuel tube plate is correctly
R positioned. The sealed holes in the
R seal plate centre must be coincident
R with the fuel transfer ports of the

R fuel tube plate for sealing to be
R effective.

(c) Renew a suspected defective seal or component and then repeat the pressure test and leak checks.

(3) On completion of pressure test, complete the procedure as detailed in 73-14-01 Removal/ Installation.



Fuel Heater and Filter Seal Failure Drains
Transfer Passages and Outlets
Figure 501

FUEL HEATER AIR VALVE - REMOVAL/INSTALLATION

1. General

R This chapter details the procedures for the removal and
R installation of an air valve and solenoid valve as an assembly
R in paragraph 3, and for a solenoid valve as a separate item
R in paragraph 4. The removal/installation of a solenoid valve
R relates to a valve to S.B.OL.593-75-6 and 75-7 standard.

R Details of approved servicing and storage materials quoted
R in this chapter are given in 70-00-01.

2. Tools and Equipment

Circuit breaker safety clip ... ... -

R 3. Air Valve (Ref. Fig. 401)

A. Prepare to Remove Valve.

(1) Open engine bay rear lower door (Ref.71-00-00, Servicing).

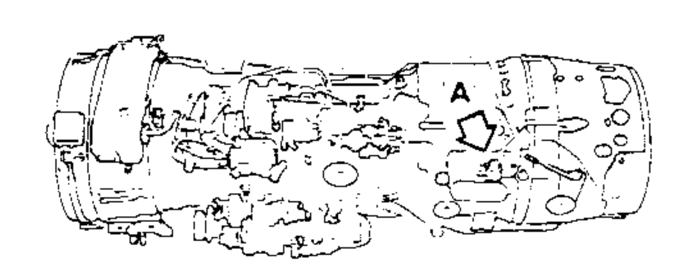
(2) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engines No.1 and No.4			
FUEL HEATER AUTO CONT	15-216	H1331	A11
FUEL HTR IND AND MANL CONT	5-213	H1333	B 5
Engines No.2 and No.3			
FUEL HEATER AUTO CONT	15-215	H1332	E16
FUEL HTR IND AND MANL CONT	1-213	H1334	F 8

Circuit Breakers
Table 401

(3) Disconnect solenoid valve electrical lead end plug.

CR 30481/00B



AIR VALVE

LEAD SUPPORT BRACKET

A

SOLENOID ELECTRICAL CONNECTION

VALVE SUPPORT BRACKET

SUPPORT TUBE

DRAINS TANK

CMR 73 14 02 4 AAM0

Air Valve and Location Detail
Figure 401

R

R (4) Support air valve, remove bolts from front and rear flanges and remove valve from engine.

B. Install Valve.

R (1) Apply lubricant B to retaining bolts.

(2) Position valve on engine as shown. Secure front flange together with electrical lead and valve support brackets with six bolts. Secure rear flange with five bolts. Torque-tighten all bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(3) Connect solenoid valve electrical lead end plug.

(a) On engines to pre S.B.OL.593-71-15 standard, connect, tighten and wire-lock lead end plug.

(b) On engines to S.B.OL.593-71-15 standard, connect, tighten and ensure that a white line is painted across the connection join to indicate final tightened position.

C. Complete the Installation.

R (1) Remove safety clip and reset fuel heater air valve solenoid circuit breaker (Ref. Table 401).

R (2) With an operator positioned at the fuel heater
R air valve, operate the valve selector switch and verify that the solenoid operates. Valve operation is audible.

(3) Close engine bay rear lower door (Ref.71-00-00, Servicing).

4. <u>Solenoid Valve</u> (Ref. Fig. 402)

A. Prepare to Remove Valve.

(1) Open engine bay rear lower door (Ref.71-00-00, Servicing).

(2) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

B. Remove Valve.

(1) Disconnect solenoid valve electrical lead end plug.

CR 30482/00B

A

SOLENOID VALVE

AIR VALVE

SOLENOID ELECTRICAL
CONNECTION

A

DRAINS TANK

CMR 73 14 02 4 BAMO

R Solenoid Valve and Location Detail
Figure 402

R (2) Remove bolts securing solenoid valve to air valve.

R (3) Remove solenoid valve and seal from air valve.

C. Install Valve.

R (1) Ensure that joint face on solenoid valve and air valve is clean and damage free.

R (2) Apply lubricant A to retaining bolts.

(3) Position solenoid valve on control valve with a new seal interposed between joint faces.

R (4) Secure solenoid valve to air valve with four bolts torque-tightened to 35 lbf in. (3,9 N.m). Wire-lock bolts.

(5) Connect solenoid valve electrical lead end plug.

(a) On engines to pre S.B.OL.593-71-15 standard, connect, tighten and wire-lock lead end plug.

(b) On engines to S.B.OL.593-71-15 standard, connect, tighten and ensure that a white line is painted across the connection join to indicate final tightened position.

D. Complete the Installation.

(1) Remove safety clip and reset fuel heater control and indication circuit breaker (Ref. Table 401).

R (2) With an operator positioned at the fuel heater
R air valve, operate the valve selector switch and verify that the solenoid operates. Valve operation is audible.

(3) Close engine bay rear lower door (Ref.71-00-00, Servicing).

R (4) Carry out checks specified for fuel heater air valve (Ref.71-00-00, Adjustment/Test, Table 501).

R FUEL HEATER AIR VALVE
INSPECTION/CHECK

1. General

The procedure detailed in paragraph 3 is carried out in order
R to check the fuel heater air valve for a mechanical seizure.

R Details of approved Servicing and Storage materials
R quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Circuit breaker safety clips ... ... -

R 3. Fuel Heater Air Valve (Ref. Fig. 601)

A. Prepare to Check Valve.

(1) Open engine bay rear lower door (Ref.71-00-00, Servicing).

(2) Electrically isolate the engine additional services indicated in Table 601 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engines No.1 and No.4			
R	FUEL HTR AUTO CONT	15-216	H1331	A11
R	FUEL HTR IND AND MANL			
R	CONT	5-213	H1333	B5
	Engines No.2 and No.3			
R	FUEL HTR AUTO CONT	15-215	H1332	E16
R	FUEL HTR IND AND MANL			
R	CONT	1-213	H1334	F8

Circuit Breakers
Table 601

R (3) Remove the air valve air outlet elbow.

R (a) Remove five bolts securing elbow to air valve rear flange.

CR 31665/00B

SOLENOID ELECTRICAL CONNECTION
SOLENOID VALVE
TUBE FLANGE
SUPPORT BRACKET
SHUT-OFF HEAD
AIR VALVE
AIR OUTLET ELBOW
DRAINS TANK

CMR 73 14 02 6 AAMO

R Fuel Heater Air Valve
Figure 601

(b) Support elbow and remove six nuts and bolts securing elbow and support bracket to tube flange. Remove the elbow.

B. Check Procedure.

(1) Squarely depress the shut-off head, by hand, and check for freedom of movement.

NOTE: The spring load is approximately 4 lb (1,8 kg).

(2) Release the shut-off head, for a satisfactory check ensure that the head returns and reseats under the spring load.

(3) On completion of a satisfactory check, install the air outlet elbow and complete the check as detailed in paragraph 3.C.

R (4) If the air valve fails to meet the check requirements a new unit must be installed as detailed in 73-14-02, Removal/Installation. The air outlet elbow can then be installed and the check completed as detailed in paragraph C.

C. Complete Check.

R (1) Apply lubricant B to attachment nuts and bolts.

R (2) Install the air valve air outlet elbow.

R (a) Support elbow and secure to the air valve rear flange with five bolts, lightly tightened.

(b) Secure elbow and support bracket to the tube flange with six nuts and bolts, torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(c) Torque-tighten the five bolts securing the elbow
R to the air valve rear flange to between 67
R and 73 lbf in. (7,6 and 8,2 N.m).

(3) Remove safety clips and reset the engine additional services circuit breakers (Ref. Table 601).

(4) Close engine bay rear lower door (Ref. 71-00-00, Servicing).

FUEL HEATER CONTROL VALVE SWITCH (DIFFERENTIAL PRESSURE) - REMOVAL/INSTALLATION

1. General

General

R On engines to S.B.OL.593-73-41 standard, the fuel heater
R control valve switch has been replaced by a blanking cover.
R This chapter details separate procedures for both standards.

Details of approved servicing and storage materials quoted in this Chapter are given in 70-00-01.

2. Tools and Equipment

Air bleed tube	PE.22898
Drain Tube (Pre S.B.OL.593-73-1 drain valve)	PE.34076
Drain Tube (S.B.OL.593-73-1 drain valve)	PE.26796
Drain tube for heater and filter drain valve	PE.21970
Circuit breaker safety clip...	-

R 3. Control Valve Switch (Ref. Fig.401 and 402)

A. Prepare to Remove Switch.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
FUEL HTR AUTO CONT	15-216	H1331	A11
FUEL HTR IND AND MANUAL CONT	5-213	H1333	B5

Printed in England

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.2			
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19
FUEL HTR AUTO CONT	15-215	H1332	E16
FUEL HTR IND AND MANUAL CONT	1-213	H1334	F8
Engine No.3			
LP VALVE SUP 1	15-216	3Q1	F1
LP VALVE SUP 2	15-215	3Q2	C20
FUEL HTR AUTO CONT	15-215	H1332	E16
FUEL HTR IND AND MANUAL CONT	1-213	H1334	F8
Engine No.4			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-
FUEL HTR AUTO CONT	15-216	H1331	A11
FUEL HTR IND AND MANUAL CONT	5-213	H1333	B5

Circuit Breakers
Table 401

(4) Drain the engine fuel system.

(a) Open bleed valve to expedite draining.

(b) Use drain tube PE.34076 (Pre S.B.OL.593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE.21970 at the fuel heater and filter drain valve. Direct free ends of drain tubes into a container and drain the system upstream of the FCU.

(c) When fuel drain ceases, remove the drain tubes and close the bleed valve.

NOTE: Discard drained fuel or inhibiting fluid.

(5) Unscrew and remove fuel heater air duct spring housing assembly.

R B. Remove Switch/Blanking Cover.

CR 30449/00B

FUEL HEATER AND FILTER

FUEL PRESSURE DIFFERENTIAL WARNING SWITCH

SEAL PLATE

FUEL SERVC TUBE PLATE

FIRST STAGE FUEL PUMP

CMR 73 14 04 4 AAM0

Control Valve Switch (Pre S.B.OL.593-73-41 Standard) Details
Figure 401

R

(1) On engines to pre S.B.OL.593-73-41 standard (Ref. Fig. 401), remove switch.

(a) If installed, disconnect electrical lead end plug.

(b) Unscrew attachment bolts and remove switch and seal plates. Support detached end of fuel servo tube.

(2) On engines to S.B.OL.593-73-41 standard (Ref. Fig. 402), remove blanking cover.

(a) Unscrew attachment bolts and remove blanking cover and seal plates. Support detached end of fuel servo tube.

C. Install Switch/Blanking Cover.

CAUTION: ENSURE ATTACHMENT BOLTS AND THEIR CORRESPONDING THREADED HOLES ARE TO THE SAME SERVICE BULLETIN STANDARD (REF.S.B.OL.593-73-40).

(1) On engines to pre S.B.OL.593-73-41 standard (Ref. Fig. 401), install switch.

(a) Apply lubricant B to securing bolts.

(b) Assemble a serviceable seal plate (Ref.70-00-03, Sealing Devices) between fuel servo tube plate and heater and filter mounting face, ensuring
R assembly pin is engaged and attachment holes are
R aligned and hold in position.

(c) Assemble a serviceable seal plate to pressure switch.

(d) With assembly pin engaged with hole, position switch and seal plate on fuel tube plate.

(e) Secure switch with five bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(f) If lead end plug is available connect, tighten and wire-lock it.

(2) On engines to S.B.OL.593-73-41 standard (Ref. Fig. 402) install blanking cover.

(a) Apply lubricant B to securing bolts.

CR 34552/00A

FUEL HEATER AND FILTER

FUEL PRESSURE DIFFERENTIAL WARNING SWITCH

SEAL PLATE

BLANKING COVER

FUEL SERVO TUBE PLATE

FIRST STAGE FUEL PUMP

CMR 73 14 04 4 BAMO

Blanking Cover Details (S.B.OL.593-73-41 Standard)
Figure 402

R

(b) Assemble a serviceable seal plate (Ref.70-00-03, Sealing Devices) between fuel servo tube plate and filter mounting face, ensuring assembly pin
R is engaged and attachment holes are aligned and
R hold in position.

R (c) Locate a second serviceable seal plate against
R the fuel servo tube plate in a position that
R corresponds with the first seal plate. Ensure
R that the two central sealed holes of the seal
R plates are conincident with the two fuel transfer
R ports in the fuel tube plate and then position
R the blanking cover against the seal plate with
R the attachment holes aligned.

R (d) Secure items in assembled position with five
R bolts, torque-tightened to between 85 and
R 95 lbf in. (9,6 and 10,7 N.m).

R NOTE: A leak will result if the blanking
R cover seal plate central holes are not
R conincident with the two fuel transfer
R ports in the fuel servo tube plate.

D. Check for Leaks at Connections Disturbed During Procedure

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure - comply with the procedures given in 73-14-04, Adjustment/Test, paragraph 2.

(b) PTIR pressure - comply with the procedures given in 73-14-04, ADjustment/Test, paragraph 3

(c) On completion of static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph E.

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph E.

E. Complete the Installation

(1) Screw spring housing assembly onto fuel heater air duct end (Ref.71-00-02, Power Plant Build-up).

(2) If a leak check is to be made during an engine run carry out a preliminary leak check using the aircraft

fuel feed pumps.

(a) Remove safety clips, reset cirucit breakers (Ref. Table 401) and open the LP fuel isolation valve.

(b) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all air from the system.

(c) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

(e) On completion of check, switch off the aircraft fuel feed pumps.

(3) To complete the installation or prepare for ground run, install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(4) Remove safety clips, reset circuit breakers (Ref. Table 401) and open the LP fuel isolation valve.

(5) If the fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing) that are required for the engine run checks, and comply with the procedures of 73-00-00 and 71-00-00, Adjustment/Test respectively. On completion of engine run, retrip circuit breakers and attach safety clips.

(6) Close engine bay doors (Ref.71-00-00, Servicing).

FUEL HEATER CONTROL VALVE SWITCH (DIFFERENTIAL PRESSURE) - ADJUSTMENT/TEST

1. Pressure Test and Leak Check the Switch

A. General.

This procedure is complementary to the Removal/Installation of the fuel heater control valve switch/blanking cover and gives the procedures for a static pressure test. The test is carried out using the test procedures, tools and equipment detailed for the reheat fuel flowmeter.

B. Carry Out Static Pressure Test.

(1) To provide a more precise check for leaks, disconnect seal failure drains system tube union nuts from fluid passage bolt and connector at fuel heater and filter unit connection.

(2) Carry out a static pressure test and leak check with the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR) as detailed in 73-33-02, Adjustment/Test. Omit seal failure drains system tube detachment and leak check procedure at reheat fuel flowmeter drains connection and the reset procedure for the FUEL FLOW IND SUP circuit breaker.

(3) Check fuel heater and filter unit seal failure drains connection for signs of leaks. No leaks are acceptable. If a leak is disclosed, rectify defect (Ref.para.(4)).

(4) Procedure to locate and recitfy a leak.

(a) The seal drains connection at the fuel heater and filter is interconnected internally to more than one seal. Establish the location of the defective seal(s) by reference to the illustration (Ref. Fig. 501).

(b) Renew a defective seal or component and then repeat the pressure test and leak check.

R
R NOTE: If a leak is disclosed on an
R S.B.OL.593-73-41 standard engine,
R ensure that the seal plate between
R the blanking cover and the fuel tube
R plate is correctly positioned. The
R sealed holes in the seal plate centre

R must be coincident with the fuel
R transfer ports of the fuel tube plate for
R sealing to be effective.

C. Complete the Procedure

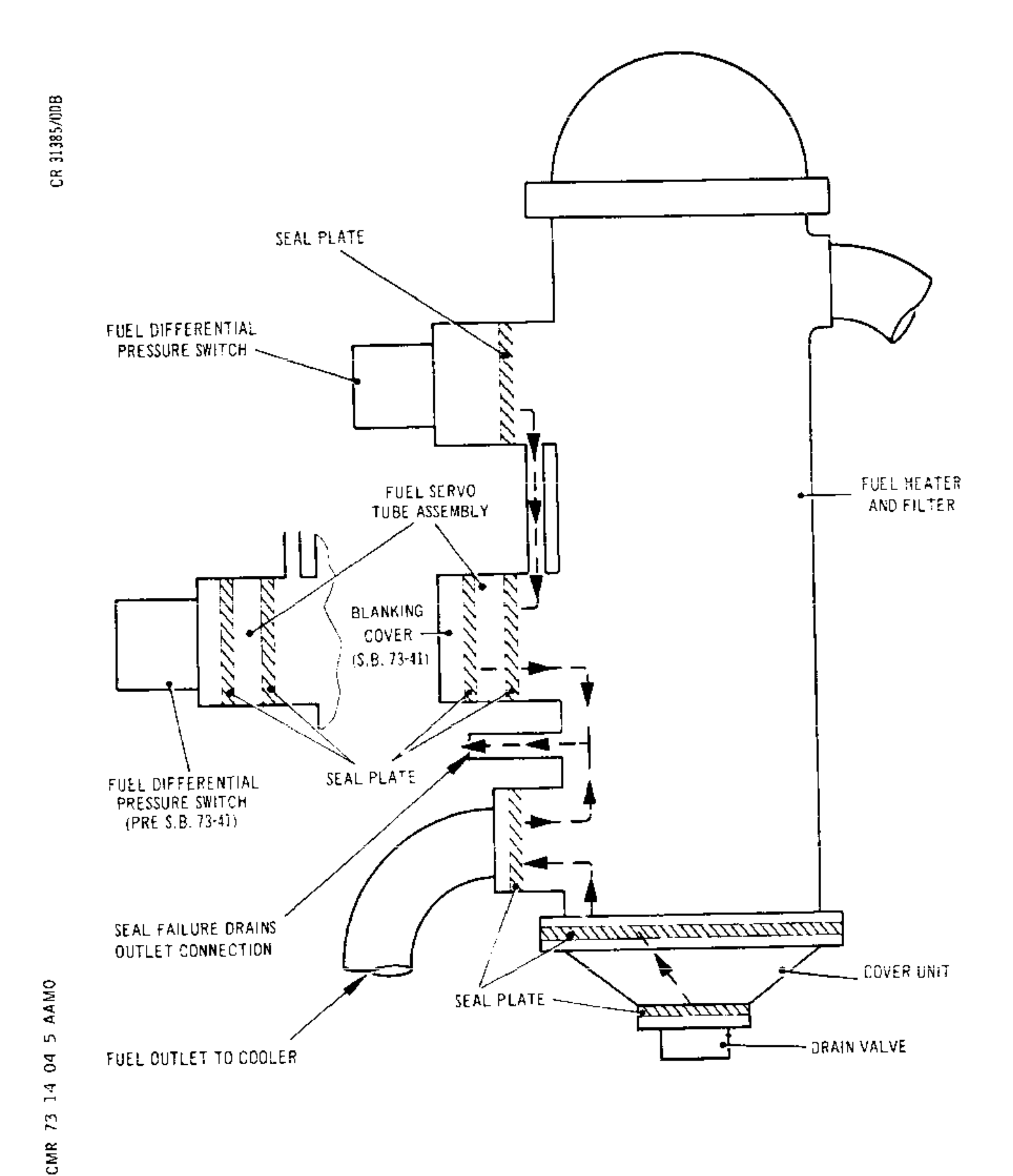
(1) Connect seal failure drains system at fuel heater and filter unit.

(a) Apply lubricant A to union connections.

(b) Connect drains system tubes to fluid passage bolt and connector, triple torque-tighten thrust wire type union nuts (Ref. 70-00-04, Torque Loading Data) to between 90 and 100 lbf in. (10,2 and 11,3 N.m).

(c) Wire-lock both union nuts.

(2) Complete the procedure as detailed in 73-14-04, Removal/Installation.



Fuel Heater and Filter Seal Failure Drains
Transfer Passages and Outlets
Figure 501

R

FUEL HEATER CONTROL THERMOMETER - REMOVAL/INSTALLATION

1. General

The fuel heater control thermometer is bolted to the first stage fuel pump with its bulb projecting into the pump case. Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Air bleed tube	PE.22898
Drain tube (Pre S.B. OL.593-73-1 drain valve) ...	PE.34076
Drain tube (S.B. OL.593-73-1 drain valve) ...	PE.26796
Drain tube for fuel heater and filter drain valve	PE.21970
Circuit breaker safety clip	-

R 3. Thermometer (Ref. Fig.401 and 402)

A. Prepare to Remove Thermometer.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is being carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
FUEL HTR AUTO CONT	15-216	H1331	A11
FUEL HTR IND AND MANL CONT	5-213	H1333	B5
Engine No.2			

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R	LP VALVE SUP 1	15-216	2Q1	F2
R	LP VALVE SUP 2	15-215	2Q2	C19
	FUEL HTR AUTO CONT	15-215	H1332	E16
R	FUEL HTR IND AND	1-213	H1334	F8
R	MANL CONT			
	<u>Engine No.3</u>			
R	LP VALVE SUP 1	15-216	3Q1	F1
R	LP VALVE SUP 2	15-215	3Q2	C20
R	FUEL HTR AUTO CONT	15-215	H1332	E16
R	FUEL HTR IND AND	1-213	H1334	F8
R	MANL CONT			
	<u>Engine No.4</u>			
R	LP VALVE SUP 1	15-216	4Q1	C2
R	LP VALVE SUP 2	16-215	4Q2	-
R	FUEL HTR AUTO CONT	15-216	H1331	A11
R	FUEL HTR IND AND	5-213	H1333	B5
R	MANL CONT			

Circuit Breakers
Table 401

R (4) Drain the engine fuel system.

R (a) Open bleed valve to expedite draining.

R (b) Use drain tube PE.34076 (Pre S.B. OL.593-73-1 drain valve) or PE.26796 (S.B. OL.593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE.21970 at the fuel heater and filter drain valve. Direct free ends of drain tubes into a container and drain the system upstream of the FCU.

R (c) When fuel drain ceases, remove the drain tubes and close the bleed valve.

NOTE: Discard drained fuel or inhibiting fluid.

(5) Remove heater and filter unit steady bracket.

(a) Remove bolts securing steady bracket to bracket mounted on main oil pump and remove plate.

(b) On engines to pre S.B. OL.593-73-37 standard (Ref. Fig. 401), remove bolts and washers securing steady bracket to heater and filter unit then remove bracket and locating plate.

(c) On engines to S.B. OL.593-73-37 standard (Ref. Fig. 402), remove bolts and washers securing steady bracket to heater and filter unit then remove bracket and distance piece.

B. Remove Thermometer.

(1) Disconnect electrical lead end plug.

(2) Remove bolts and withdraw thermometer and seal plate from pump.

C. Install Thermometer.

(1) Assemble serviceable seal plate (Ref. 70-00-03, Sealing Devices) to thermometer.

(2) Assemble thermometer and seal plate to first stage pump location.

(3) Apply lubricant B and secure thermometer with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(4) Connect, tighten and wire-lock lead end plug.

D. Install Heater and Filter Unit Steady Bracket.

(1) Apply lubricant B to attachment bolts.

(2) Assemble heater and filter unit steady bracket.

(a) On engines to pre S.B. OL.593-73-37 standard (Ref. Fig. 401), assemble bracket and locating plate at heater and filter location and secure with four bolts and washers. Lightly tighten bolts.

(b) On engines to S.B. OL.593-73-37 standard

CR 30479 / 00A

THERMOMETER

A

SEAL PLATE

FIRST STAGE
FUEL PUMP

FUEL HEATER AND FILTER

A

CMR 73 14 05 4 AAMO

FORWARD

PLATE

STEADY BRACKET

LOCATING PLATE

Fuel Heater Control Thermometer
(Pre S.B.OL.593-73-37 Standard)
Figure 401

(Ref. Fig. 402), assemble bracket and distance piece at heater and filter location and secure with four bolts and washers. Lightly tighten bolts.

(3) Assemble plate and steady bracket to bracket mounted on main oil pump and secure with two bolts. Ensure bracket serrations are aligned.

R (4) Torque-tighten bolts to between 85 and 95 lbf in. (9 and 10,2 N.m).

E. Check for Leaks at Connections Disturbed During Procedure.

(1) If a static pressure test for fuel leaks is to be carried out.

(a) Use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR) as given in 73-14-05, Adjustment/Test.

(b) On completion of static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph F.

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph F.

F. Restore Engine to Flight Standard.

(1) If a leak check is to be made during an engine run carry out a preliminary leak check using the aircraft fuel feed pumps.

(a) Remove safety clips, reset circuit breakers (Ref Table 401) and open the LP fuel isolation valve.

(b) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all air from the system.

(c) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank

CR 345.0.00A

THERMOMETER

A

SEAL PLATE

FIRST STAGE
FUEL PUMP

FUEL HEATER AND FILTER

A

FORWARD

PLATE

STEADY BRACKET

DISTANCE PIECE

CMR 73 14 05 4 DAMO

Fuel Heater Control Thermometer
(S.B.OL.593-73-37 Standard)
Figure 402

R

overflow vent. No leaks are acceptable.

(e) On completion of check, switch off the aircraft fuel feed pumps.

(2) To complete the installation or prepare for ground run, install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(3) Remove safety clips, reset circuit breakers (Ref. Table 401), and open the LP fuel isolation valve.

(4) If the fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref. 71-00-00, Servicing) that are required for the engine run checks, and comply with the procedures of 73-00-00 and 71-00-00, Adjustment/ Test respectively. On completion of engine run, retrip circuit breakers and attach safety clips.

(5) Close engine bay doors (Ref.71-00-00. Servicing).

FUEL HEATER CONTROL THERMOMETER - ADJUSTMENT/TEST

1. Pressure Test and Leak Check the Thermometer

A. General.

This procedure is complementary to the Removal/Installation of the fuel heater control thermometer and gives the procedures for a static pressure test. The test is carried out using the test procedures, tools and equipment detailed for the reheat fuel flowmeter.

B. Carry out Static Pressure Test.

(1) To provide a more precise check for leaks, disconnect seal failure drains system tube union nuts from union adapter and connector at first stage pump connection.

(2) Carry out a static pressure test and leak check with the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR) as detailed in 73-33-02, Adjustment/Test. Omit seal failure drains system tube detachment and leak check procedure at reheat fuel flowmeter drains connection and the reset procedure for the FUEL FLOW IND SUP circuit breaker.

(3) Check first stage pump seal failure drains connection for signs of leaks. No leaks are acceptable. If a leak is disclosed, rectify defect (Ref.para (4)).

(4) Procedure to locate and rectify a leak.

(a) The seal drains connection at the first stage pump is interconnected internally to more than one seal. Establish the location of the defective seal(s) by reference to the illustration (Ref. Fig. 501).

(b) Renew a defective seal or component and then repeat the pressure test and leak check.

C. Complete the Procedure.

(1) Connect seql failure drains system at first stage pump connection.

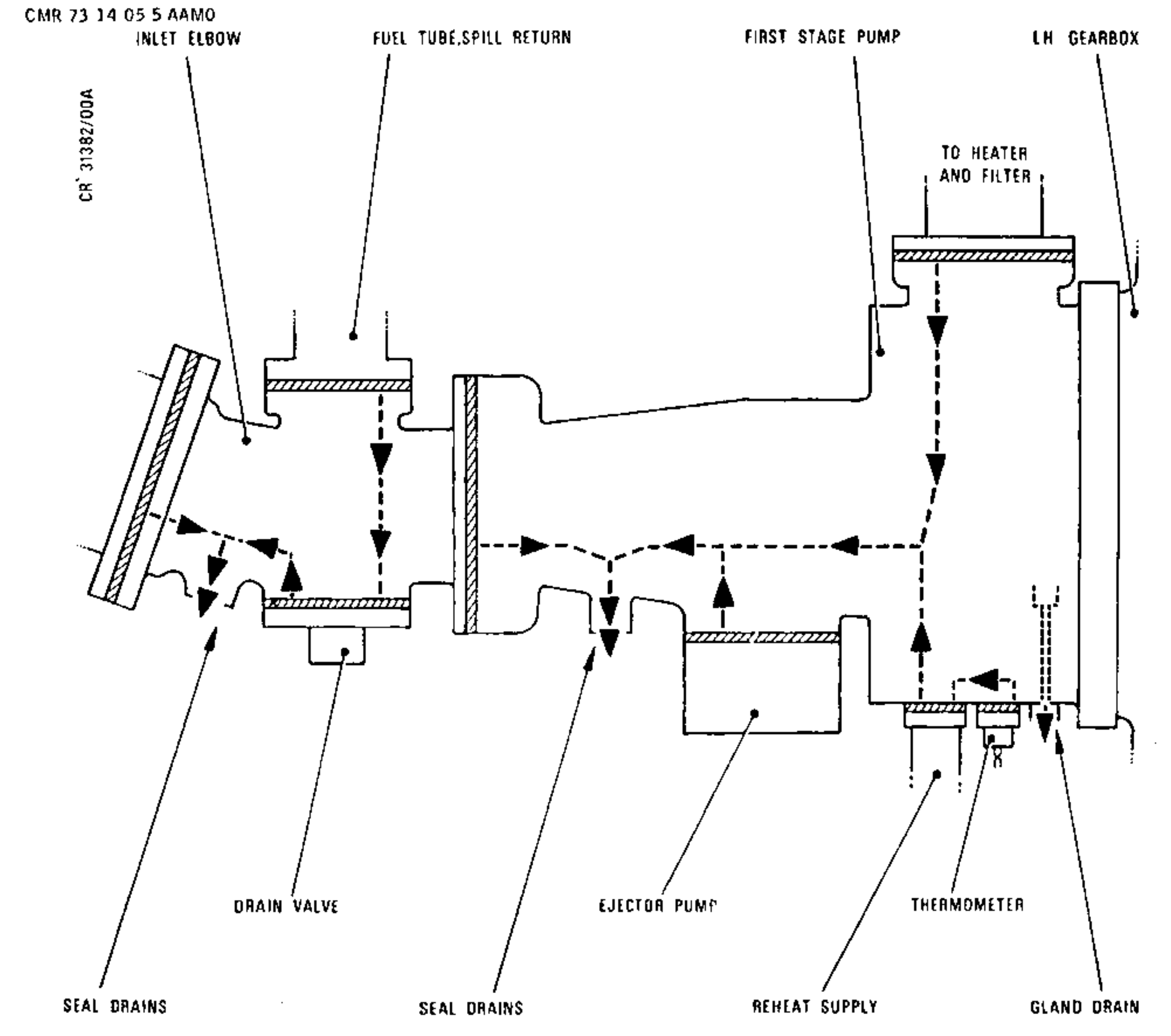
(a) Apply lubricant A to union connections.

(b) Connect drain system tubes to union adapter and connector, triple torque-tighten thrust wire type union nuts (Ref.70-00-04, Torque

Loading Data) to between 90 and 100 lbf in. (10,2 and 11,3 N.m).

(c) Wire-lock both nuts.

(2) Complete the procedure as detailed in 73-14-05, Removal/Installation.



First Stage Pump Seal Failure Drains Transfer Passages and Outlets!
Figure 501

FUEL HEATER CONTROL UNIT - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

1. General

The fuel heater control units are single elfin units mounted in the flight compartment racking.

2. Control Unit

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-

B. Prepare

(1) Trip the appropriate circuit breakers and secure them with safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.1			
ENG 1 & 4 FUEL HTR AUTO CONT	15-216	H1331	A11
ENG 1 & 4 FUEL HTR IND & MANL CONT	5-213	H1333	B 5
Engine No.2			
ENG 2 & 3 FUEL HTR AUTO CONT	15-215	H1332	E16
ENG 2 & 3 FUEL HTR IND & MANL CONT	1-213	H1334	F 8
Engine No.3			
ENG 2 & 3 FUEL HTR AUTO CONT	15-215	H1332	E16
ENG 2 & 3 FUEL HTR IND & MANL CONT	1-213	H1334	F 8
Engine No.4			
ENG 1 & 4 FUEL HTR AUTO CONT	15-216	H1331	A11
ENG 1 & 4 FUEL HTR IND & MANL CONT	5-213	H1333	B 5

(2) Enter the flight compartment and locate the shelf assembly.

(3) Remove the cover from the shelf assembly and locate the control unit:

ENGINE NO.	SHELF	ENGRAVING
No.1	2-215	1H1336
No.2	1-215	2H1336
No.3	1-216	3H1336
No.4	2-216	4H1336

C. Remove

(1) Slacken the knurled screws.

(2) Withdraw the control unit, using the handle, and remove it from the shelf.

D. Prepare to Install

(1) Comply with the electrical safety precautions.

(2) Ensure that the racking is clean and the connector pins are undamaged.

(3) Check that the connecting pins, on the control unit, are clean and undamaged.

E. Install

(1) Engage the control unit with the racking, slide the unit firmly into position and tighten the knurled securing screws.

(2) Check that the control unit is firmly bonded in accordance with 20-27-11.

F. Conclusion

(1) Refit the cover to the shelf assembly.

(2) Remove the safety clips and reset the circuit breakers previously tripped.

(3) Carry out an Operational test of the fuel heating

system (Ref. 73-14-00, Adjustment/Test).

CONTROLLING - DESCRIPTION AND OPERATION

1. General

The fuel control system controlling function ensures that the fuel supplied to the combustion systems is at the flow rate necessary to obtain the power demanded by the engine and reheat control systems. The power demand is determined by the pilots throttle lever setting, reheat control selection, and the engine operation sensing signals which act on the fuel flow control system through the engine control amplifiers and the reheat control amplifier (Ref.Fig.001 and Fig.002). Engine and reheat control system operation is described in 76-00-00.

The engine system fuel controlling component is the flow control unit (FCU). A speed probe unit and its low speed governor amplifier, described in 73-22-00, control the LP overspeed governor of the FCU. A throttle valve actuator gearbox, an engine control component, is mounted on the bottom of the FCU and transmits its drive via a splined shaft and coupling. The FCU meters the fuel flow from the pumps of the distribution system (Ref.73-10-00) for distribution to the fuel sprayers as shown in Figure 003.

The reheat fuel controlling components are the reheat fuel controller, incorporating a purge valve with a position transmitter, and a reheat purge air controlling solenoid
R valve. On engines to SB OL593-76-14064-52 standard, the
R electrical leads to the solenoid valve are disconnected and
R thus removes the controlled purge function. Unlike the FCU, the driving motor and gears for the metering valve of the unit are incorporated within the unit. The controller meters first stage pump fuel to be discharged at the spray ring of the reheat injection system (Ref.Fig.003).

Descriptions of the components are given in paragraphs 2 to 6, the operation of the engine fuel controlling system in paragraph 7 and the operation of the reheat system in paragraph 8.

2. Engine Flow Control Unit (FCU)

A. General (Ref.Fig.003 and Fig.004).

A simplified description of the FCU and its controlling function in the fuel system is given in this chapter while a detailed description and operation of the FCU as a unit is to be found in 73-21-01.

CR 31523.00B

CMR 73 20 00 0 AAMD

PILOTS ROOF
PANEL 4-211

H P VALVE

OPEN OPEN OPEN OPEN

1 2 3 4

SHUT SHUT SHUT SHUT

1 2 3 4

SECOND STAGE PUMP

S S

START AND SHUT-DOWN
SOLENOID VALVES

SERVO FUEL TO
MANIFOLD DUMP VALVE

FUEL FROM
FIRST STAGE
PUMP

HP SHUT-OFF VALVE
PRESSURE SPILL

FLOW CONTROL UNIT

DISTRIBUTION
VALVES

HP SHUT-OFF VALVE
POSITION TRANSDUCER

FUEL TO
SPRAYERS

MANIFOLD
DUMP VALVE

FUEL FROM
ELECTRIC STARTER
PUMP AND
FIRST STAGE
PUMP

S

ENGINE FUEL
FLOWMETER

ELECTRO
PRESSURE
CONTROL

FUEL SPILL RETURN

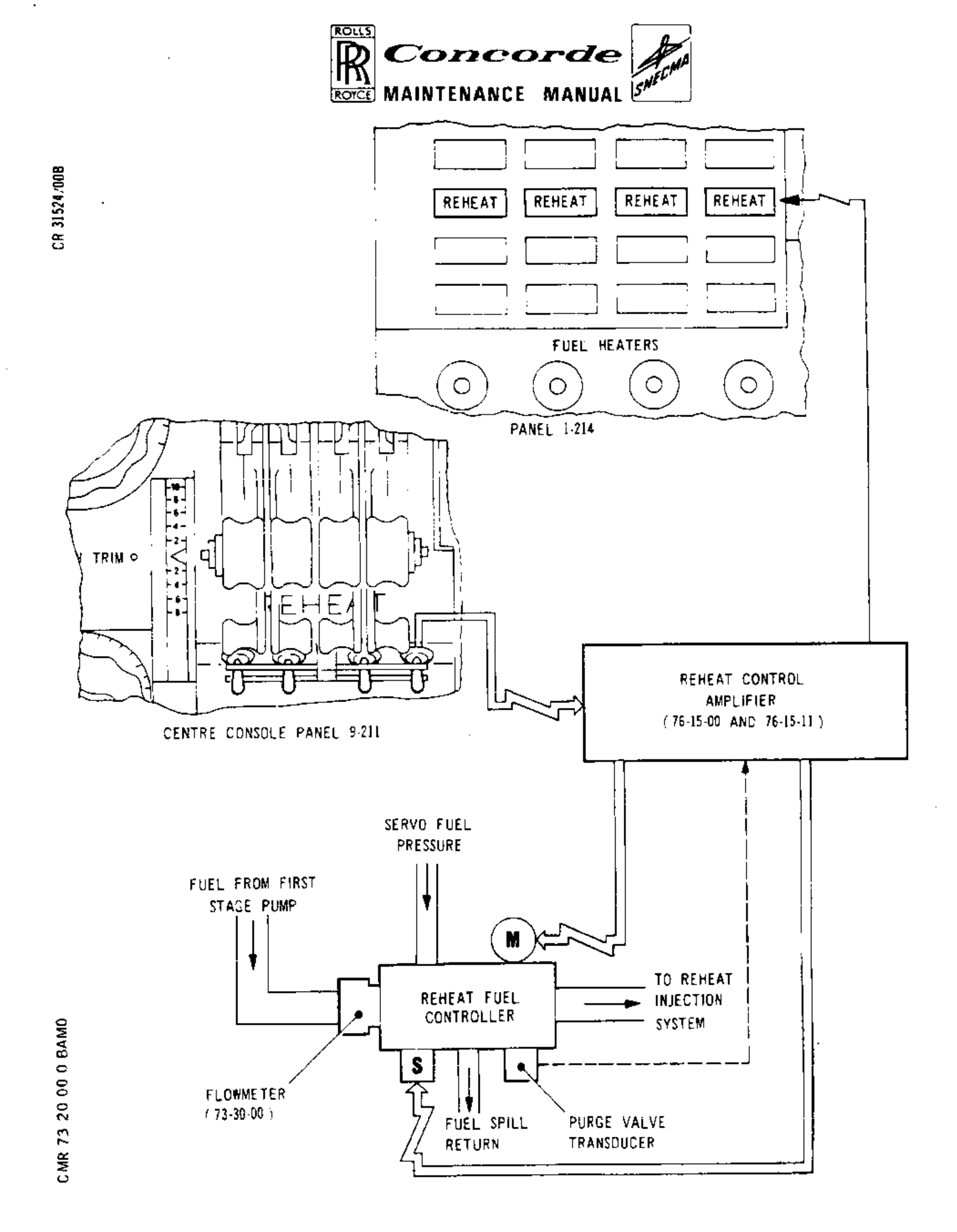
AMPLIFIER

PROBE

LP COMPRESSOR OVERSPEED GOVERNING SYSTEM (73-22-00)

Engine Fuel Controlling Schematic
Figure 001

R



Engine Fuel Controlling Schematic
Figure 002

R

The FCU is mounted on the rear face of the LH gearbox and is secured to the mounting face by a quick attach/ detach coupling. The gear drive of the FCU connects

to the gearbox drive by a splined shaft. The throttle valve actuator gearbox is bolted to the bottom of the FCU with its drive shaft splined to the throttle valve drive pinion.

A fuel control loop, consisting of a throttle valve, a servo throttle valve and a pressure drop unit, forms the fuel metering section of the FCU which also incorporates an HP shut-off valve and its controlling solenoid valves and also overspeed control systems. The overspeed governing controls consists of an HP compressor overspeed governor and an LP compressor overspeed governor with electro pressure control.

B. Throttle Valve, Servo Throttle Valve and Pressure Drop Unit (Fuel Control Loop).

The fuel control loop, formed by the throttle valve, servo throttle valve and pressure drop unit, performs the fuel metering function of the FCU to meet the power demand of the engine control system.

The throttle valve has a metering plunger that is positioned within a sleeve to expose or cover drilled ports. The drillings in the sleeve are in three sets which form a main profile, an idling profile and a potentiometer profile. The plunger is positioned within the sleeve by the throttle valve actuator gearbox through a rack and pinion drive in response to engine control system signals. The size of both the main profile and the potentiometer profile are determined by the plunger position. The variable orifice of the potentiometer profile, in conjunction with a fixed orifice, forms a potentiometer that gives a potentiometer pressure PP derived from throttle valve inlet pressure PA.

The servo throttle valve is located downstream from the throttle valve and consists of a piston free to move within a ported sleeve. An intermediate pressure PSC, derived from throttle valve inlet pressure by a fixed orifice potentiometer, is applied to one side of the piston which is opposed by an operating servo pressure PSV on the other side. The servo pressure, controlled by the pressure drop unit, positions the piston in the ported sleeve and regulates the throttle valve outlet pressure PD.

The pressure drop unit consists of a spool valve, spring loaded at one end, acting within a chamber. The free end

PF FIRST STAGE PUMP PRESSURE
PA THROTTLE VALVE INLET PRESSURE
PD THROTTLE VALVE OUTLET PRESSURE
PP THROTTLE VALVE POTENTIOMETER PRESSURE
PT SERVO THROTTLE VALVE DELIVERY PRESSURE
PB SPRAYER LINE PRESSURE
PR STARTER PUMP DELIVERY PRESSURE
PRP PILOT SPRAYER PURGE FLOW
PFR REHEAT METERING VALVE OUTLET PRESSURE
PSV SERVO PRESSURE

CR 31525/00A

FUEL RECIRCULATION VALVE
FLOW CONTROL UNIT
DUMP VALVE SERVO
THROTTLE VALVE
DISTRIBUTION AND DUMP VALVE
FIRST STAGE PUMP
HEATER AND FILTER
SECOND STAGE PUMP
SERVO THROTTLE VALVE
HP SHUT-OFF VALVE
FLOW DISTRIBUTION VALVES
PF
PA
PD
PT
PB
PB
A/C FUEL SYSTEM
PF
OIL COOLER
FLOWMETER
PSV
TO MANIFOLD AND SPRAYERS
QUICK SHUT-DOWN (EMERGENCY DUMP) VALVE
PF/PR
PP
PD
M
HP
LP
GOVERNORS
ELECTRIC STARTER PUMP
PRESSURE DROP UNIT
PILOT SPRAYERS
MANIFOLD DUMP VALVE
PR/PRP
REHEAT INJECTION SYSTEM
REHEAT SERVO
METERING VALVE
SHUT-OFF VALVE
FLOWMETER
SPRAY RING
PFR
REHEAT FUEL CONTROLLER
PURGE VALVE

CMR 73 20 00 0 CAMO

Fuel Controlling (Simplified Schematic)
Figure 003

CR 31526/00A

FUEL OUTLET CONNECTION

SOLENOID VALVES

A

MOUNTING FACE FOR SECOND STAGE PUMP

B

THROTTLE CONTROL VALVE ACTUATOR GEARBOX

FUEL INLET PORT OF FCU

SERVO TO DUMP VALVE CONNECTION

FILTER HOUSING AND STARTER PUMP SUPPLY INLET CONNECTION

FUEL SPILL RETURN CONNECTIONS

HP SHUT-OFF VALVE SERVO SPILL CONNECTION

A

B

No.2 SOLENOID (SHUTDOWN) VALVE CONNECTION

No.1 SOLENOID (START) VALVE CONNECTION

CMR 73 20 00 0 DAMA

Fuel Flow Control Unit (Sheet 1 of 2)
Figure 004

CR 31652/00A

SERVO OUTLET TO MANIFOLD DUMP VALVE

HP OVERSPEED GOVERNOR

No 2 SHUT-DOWN SOLENOID VALVE (DE-ENERGIZED-OPEN)

LOW PRESSURE SENSING VALVE

START SOLENOID VALVE (ENERGIZED-OPEN)

AIR ACTUATOR VALVE

INLET FROM STARTER PUMP AND FIRST STAGE PUMP

INLET FROM FIRST AND SECOND STAGE PUMPS

THROTTLE VALVE

FUEL CONTROL LOOP

SERVO SPILL TO DISTRIBUTION BLOCK

HP SHUT-OFF VALVE (OPEN)

OUTLET TO SPRAYERS VIA DISTRIBUTION & DUMP VALVE

PRESSURE DROP UNIT

SPILL RETURN

ELECTRO PRESSURE CONTROL AND LP OVERSPEED GOVERNOR

SERVO THROTTLE VALVE

CMR 73 20 00 0 DAMB

Fuel Flow Control Unit (Sheet 2 of 2)
Figure 004

of the spool is subjected to potentiometer pressure PP which is opposed by the spring force supplemented by throttle valve delivery pressure PA acting on the other end of the spool. A metering edge on the spool is positioned to traverse a drilled profile in the spool chamber wall.

A potentiometer, formed by the variable orifice and a fixed orifice, establishes a servo pressure PSV derived from first stage pump pressure PF.

In any one throttle valve position, a main profile and a potentiometer profile will be set. The pressure drop PA/PD across the main profile will, in that steady state condition, give the fuel flow rate specific to the profile setting. At the equivalent potentiometer profile setting, the potentiometer pressure PP is determined by throttle valve inlet pressure PA, upstream of the fixed orifice, and by throttle valve outlet pressure PD, downstream of the potentiometer profile, and a pressure difference PP/PD is established across the potentiometer profile. The pressure drop unit maintains this pressure difference constant at 20 psi by controlling the servo pressure PS that positions the servo throttle valve and establishes throttle valve outlet pressure PD necessary to provide the constant pressure difference across the potentiometer profile. The throttle valve outlet pressure PD that gives the constant pressure difference establishes the desired pressure drop across the main orifice.

The operation of the fuel control loop in differing conditions of engine running is given in paragraph 7.

C. HP Shut-off Valve (Ref.Fig.004 and Fig.005).

The HP shut-off valve performs two functions:

(1) It gives positive on/off control of fuel flow during starting and at shut-down.

(2) It reacts in response to overspeed governor control to throttle the fuel flow and so limit an engine overspeed.

The valve consists of a spring-loaded differential area piston and plunger. The plunger acts in a ported sleeve in the main fuel flow line downstream from the servo throttle valve. The plunger incorporates a non-return valve that ensures a quick response of the shut-off valve towards closed when the overspeed governors operate. An operating rod projects from the piston and actuates the

CR 31530/008

PA TO DUMP VALVE
PLATE VALVES OPEN
PC
PA
PC
PA
PC
PC
HP GOVERNOR
PXS
SHUT-OFF VALVE
PT
PT
PB
PXS
PXS
S
PF
PH

PA	THROTTLE VALVE INLET PRESSURE
PC	HP SHUT-OFF VALVE PRESSURE
PT	SERVO THROTTLE VALVE DELIVERY PRESSURE
PB	ATOMIZING NOZZLE LINE PRESSURE
PH	LP GOVERNOR INTERMEDIATE PRESSURE
PXS	SPILL RETURN TO FIRST STAGE PUMP INLET

SHUT-DOWN SOLENOID VALVE (DE-ENERGIZED-OPEN)
START SOLENOID VALVE (ENERGIZED-OPEN)
PC SPILL TO FUEL ATOMIZING NOZZLE LINE

ENGINE RUNNING

ELECTRO PRESSURE CONTROL AND LP GOVERNOR

PLATE VALVES CLOSED
NO FLOW TO DUMP VALVE
START SOLENOID VALVE (DE-ENERGIZED - CLOSED)
PA
PA
PA
SHUT-OFF VALVE CLOSING
PT
SHUT-DOWN SOLENOID VALVE (ENERGIZED - CLOSED)
NO SPILL FLOW

ENGINE SHUT-DOWN ACTION

PT SPILL FROM SHUT-OFF VALVE
SOLENOID ENERGIZING
PXS
S
PF
PH

LP GOVERNOR OPERATING

CMR 73 20 00 0 EAMO

HP Shut-off Valve and Governor Action
Figure 005

R

linkage of two plate valves. One valve controls a servo flow to the manifold dump valve in the distribution and dump valve and the other controls a flow to the shut-down solenoid valve that ensures the HP shut-off valve is held in its last set position should the electrical power supply to the solenoid valves fail.

The underside of the piston is subjected to servo throttle valve delivery pressure PT and sprayer line pressure PB acts on the plunger, both pressures act in an opening sense. HP shut-off valve pressure PC, derived from throttle valve inlet pressure, and a spring force act on the upperside of the piston in a closing sense. Passages connect from above the piston to the HP and LP overspeed governor valves, to the shut-down solenoid valve via a plate valve and direct to the start solenoid valve.

A switch in the flight compartment controls the start and shut-down solenoid valves which, in turn, control the hydraulic operation of the shut-off valve.

D. Start and Shut-down Solenoid (No.1 and No.2) Valves.

The start and shut-down solenoid valves control the hydraulic operation of the HP shut-off valve.

The start solenoid valve, No.1 valve, is spring-loaded to the closed position and opens when the solenoid is energized.

The shut-down solenoid valve, No.2 valve, is spring-loaded to the open position and closes when the solenoid is energized.

E. Air Actuator Valve.

The air actuator valve initiates and controls the operation of the second stage pump. The valve consists of a differential area piston, spring-loaded to one end of a chamber. A spherical bearing connects to an external rod that operates the butterfly valve in the air supply passage of the second stage pump driving turbine.

The larger area of the differential area piston is subjected to atomizing nozzle line pressure PB acting in an opening sense. The force exerted by atomizing nozzle line pressure is opposed by the spring force supplemented by air actuator intermediate pressure PFX acting on the smaller area of the piston in a closing sense. A pressure drop valve and restrictor act as a potentiometer to establish the air actuator intermediate pressure which is derived from first stage pump pressure.

As the first stage pump nears its limit of output pressure under a demand for a higher fuel flow, the balance of forces across the differential area piston is upset and the piston moves to open the air control butterfly valve.

The second stage pump then commences operation and supplements the first stage pump pressure to maintain the required throttle valve inlet pressure PA. When the desired pressure is obtained, a new balance of forces on the differential area piston is established. In this condition, the piston position holds the air control in the setting needed to provide the appropriate second stage pump output pressure and resultant throttle valve inlet pressure.

F. HP Shaft Overspeed Governor.

The governor consists of flyweights on a carrier geared to the FCU drive. The flyweights contact a profiled plunger covering a port that connects to the pressure region below the shut-off valve piston. Should an overspeed condition arise, the flyweights will move the plunger and spill the pressure PF, acting in an opening sense, from the underside of the piston. The HP shut-off valve then moves to restrict the fuel flow to the sprayers and limit the engine speed. A datum reset device enables governor operation to be checked and adjustment is provided for correction when necessary.

G. Electro Pressure Control.

The electro pressure control contains the LP compressor overspeed governor and its operating solenoid. An arm, controlled by the solenoid, holds a plate valve in spring-loaded contact against the spill port of a profiled servo piston. The servo piston operates within a sleeve and covers a spill port that connects to the region below the shut-off valve piston.

Should an overspeed condition arise, a pulse probe and amplifier, described in 73-22-00, will generate a signal of sufficient amplitude to the solenoid that the plate valve will be unseated. The pressure holding the servo valve in the port closed position is released and the servo valve moves to open the port and spill HP shut-off valve opening pressure. The HP shut-off valve reacts by moving in a closing sense, restricts the fuel flow to the atomizing nozzles and limits the engine speed.

H. Low Pressure Sensing Valve.

The low pressure sensing valve protects the second stage pump against overspeed in the event of off-loading due to a transient loss of first stage pump pressure.

A spill passage from the opening side of the air actuator valve is held closed by a plate valve under a spring loading determined by the position of a piston actuated by first stage pump pressure.

A decrease in first stage pump pressure PF allows the piston to move and decrease the spring loading of the plate valve. Under conditions where a second stage pump overspeed is possible the valve will unseat and spill atomizing nozzle line pressure PB and result in the air actuator valve in closing the air control butterfly valve and stopping the pump.

3. Speed Probe Unit and Low Speed Governor Amplifier

The probe and amplifier provide a signal and output to operate the electro pressure control for LP compressor overspeed governor. The units and their operation are described in 73-22-00.

4. Reheat Fuel Controller

The reheat fuel controller, (Ref.Fig.006), meters fuel, supplied by the first stage fuel pump, to the reheat injection system.

The controller contains a metering valve, gear driven by an integral electric motor, and an hydraulically operated shut-off valve, controlled by a solenoid operated servo valve. The controller fuel outlet incorporates a spring-loaded purge valve. Inlet and outlet air connections on the purge valve connect to an air purge system.

5. Purge Valve Transducer

A transducer is located on the purge valve to sense valve position and provide an electrical link with the control system for air purge operation.

6. Purge Air Solenoid Valve

The purge air solenoid valve, (Ref.Fig.007), provides two parallel air passages. One passage incorporates a restrictor, which passes a continuous air flow when the engine is running, and the other passage has a solenoid operated valve which allows the passage of air when energized by the reheat control

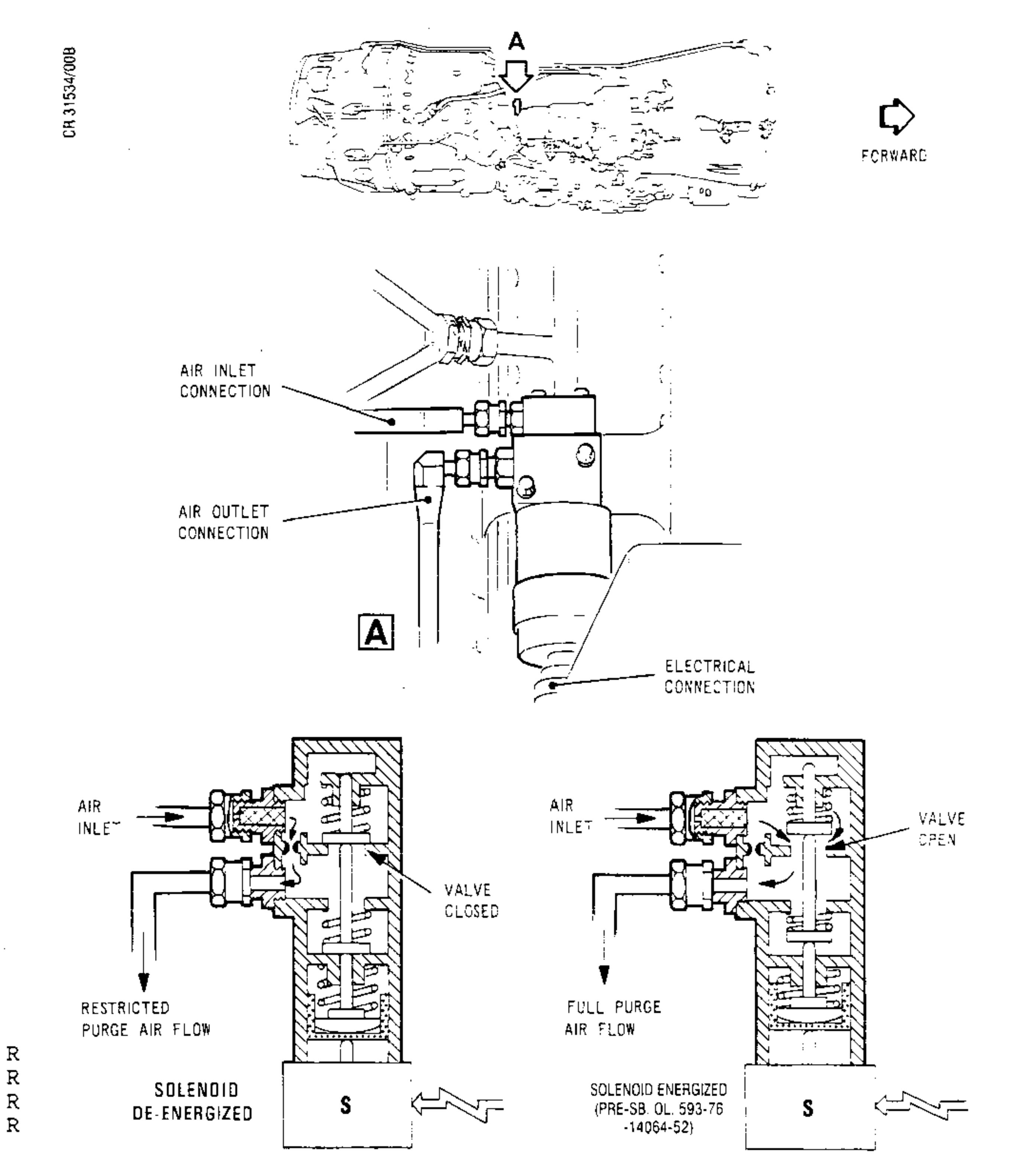
CR 31533/00A

OUTLET CONNECTION TO INJECTION SYSTEM
SOLENOID SHUT-OFF VALVE CONNECTION
METERING VALVE MOTOR CONNECTION
PURGE VALVE TRANSDUCER CONNECTION
SPILL RETURN CONNECTION
PURGE AIR CONNECTIONS
INLET ELBOW CONNECTION
FLOWMETER

METERING VALVE
M
SOLENOID SHUT-OFF VALVE (DE-ENERGIZED)
SPILL RETURN
S
PF (SERVO)
METERING VALVE BALANCE PRESSURE
SHUT-OFF VALVE (CLOSED)
S
TO INJECTION SYSTEM
SOLENOID SHUT-OFF VALVE (ENERGIZED)
PURGE VALVE TRANSDUCER
SHUT-OFF VALVE (OPEN)
PURGE VALVE

CMR 73 20 00 0 FAM0

Reheat Fuel Controller
Figure 006



R
R
R
R

Purge Air Solenoid Valve
Figure 007

CR 31532/00C

CMR 73 20 00 0 HAMO

NOTE:
SHOWN WITH NO POWER SUPPLY AT THE BUSBAR. HP VALVE RELAY THEREFORE SHOWN DE-ENERGISED.

HP Shut-off Valve Control Circuit
Figure 008

R

R system after reheat shut-down. On engines to SB OL593-76-
R 14064-52 standard, the electrical leads to the solenoid valve
R are disconnected and thus removes the controlled purge function.

7. Engine System Fuel Controlling Operation (Ref.Fig.009 and Fig.012

A. General.

The start and shut-down solenoid valves of the FCU are controlled by a selector switch in the flight compartment as shown in Figure 012 and schematically in Figure 001. An OPEN selection on the HP VALVE control switch energizes the start solenoid valve and enables the start and running conditions to be initiated. A SHUT selection energizes the shut-down solenoid valve and initiates an automatic sequence of shut-off and fuel dumping and resultant engine run-down. The circuit for the control is shown (Ref.Fig.008).

During normal engine running, the first and second stage pumps deliver a fuel flow to the FCU inlet port to be metered for distribution to the fuel sprayers. During the engine starting sequence, the electric starter pump main fuel flow is delivered to the FCU for fuel metering until the first stage pump output is adequate to meet engine demand. The starter pump operation and fuel control to the pilot fuel atomizing nozzles is described in 73-10-00.

B. Fuel Controlling Engine Running.

Fuel enters the FCU at throttle valve inlet pressure PA and is metered by the fuel control loop formed by the throttle valve, servo throttle valve and pressure drop unit. The throttle valve is positioned by the engine control system to meet the power demand and the fuel control loop meters the fuel in relation to the valve setting. From the control loop, at servo throttle valve pressure PT, the fuel passes to the HP shut-off valve and then to the distribution system at atomizing nozzle line pressure PB.

In the fuel control loop, throttle valve outlet pressure PD is regulated by the servo throttle valve setting in the fuel flow downstream of the throttle valve. Control of the servo throttle valve setting therefore controls the pressure drop PA/PD across the main profile. The pressure drop unit senses the pressures across the throttle valve as potentiometer pressure PP and pressure PD. The pressures act in opposition to position the pressure drop unit and adjust its potentiometer profile to produce servo pressure

PSV which, in turn, positions the servo throttle valve to regulate PD. A balancing pressure, servo throttle valve intermediate pressure PSC, is derived from throttle valve outlet pressure PA by a fixed orifice potentiometer and acts on the valve piston in opposition to the servo pressure PSV. A steady state condition ensues when the the throttle valve setting as determined by the PP value produced as described in paragraph 2.B. In this condition, the pressure drop unit maintains the value of PSV that positions the servo throttle valve and maintains the required PA/PD value. Changes of pressure across the throttle valve are sensed by the pressure drop unit which then acts to re-position the servo throttle valve and restore the steady state condition.

An increase in throttle valve opening demands an increase in fuel flow. This is met initially by the increase in the main profile. The resultant transient decrease in the pressure drop PA/PD across the profile is sensed by the pressure drop unit that, in turn, acts to increase pressure PSV and move the servo throttle valve in an opening sense. This establishes a PA/PD value that gives a new steady state condition with a related increased pressure drop across the increased main profile. When demand is reduced, the throttle valve closes and decreases the main profile which, after an initial transient pressure drop increase and consequent servo throttle valve movement in a closing sense, results in an accompanying decrease in the pressure drop across the reduced profile with a resulting decrease in fuel flow.

C. Fuel Controlling Engine Starting.

The electric starter pump operates during the starting cycle and delivers fuel to the FCU at starting pressure PR. The fuel at pressure PR is effective in the control loop via a non-return valve but is isolated from the delivery line of the first and second stage pumps by a second non-return valve. Passages also direct the starting pressure to the closing side of the low pressure sensing valve and to both sides of the HP shut-off valve. Fuel passed by the non-return valve is also directed via a starting flow metering orifice to the inlet side of the servo throttle valve by-passing the throttle valve.

When the HP VALVE selector switch is operated during the starting cycle to open the HP shut-off valve, the start solenoid valve is activated and opens to allow fuel to flow from the spring-loaded, closing side of the shut-off valve piston. The inlet restrictor causes a loss of pressure over the piston, the opposing force acts on the piston and

CR 31528/00A

RECIRCULATION VALVE
PF
FIRST STAGE PUMP
SECOND STAGE PUMP
P2 AIR
LOW PRESSURE SENSING VALVE
HEATER AND FILTER
PX
OIL COOLER
PF
PXS
AIR ACTUATOR VALVE
PF
TO REHEAT SYSTEM
M
PA
PFX
PISTON
PF
PA
PA
PSC
ELECTRIC STARTER PUMP
PA
PA
THROTTLE VALVE
PD
PT
PXS
PR/PRP
PA
PSV
PR/PD
SERVO THROTTLE VALVE
STARTING FLOW ORIFICE
PP
PRESSURE DROP UNIT
ACTUATOR GEAR BOX DRIVE
PSV
PD
PF
FLOW CONTROL UNIT
PXS
PXS
PR/PRP

CMR 73 20 00 0 JAMA

Engine Fuel System Diagrammatic (Sheet 1 of 2)
Figure 009

CMR 73 20 00 0 JAMB CR 31529/00C

PX	ENGINE FEED PRESSURE
PXS	SPILL RETURN TO FIRST STAGE PUMP INLET
PF	FIRST STAGE PUMP PRESSURE
PFX	AIR ACTUATOR VALVE INTERMEDIATE PRESSURE
PA	THROTTLE VALVE INLET PRESSURE
PD	THROTTLE VALVE OUTLET PRESSURE
PP	THROTTLE VALVE POTENTIOMETER PRESSURE
PC	HP SHUT-OFF VALVE PRESSURE
PSC	SERVO THROTTLE VALVE BALANCING (INTERMEDIATE) PRESSURE
PSV	SERVO PRESSURE
PT	SERVO THROTTLE VALVE DELIVERY PRESSURE
PB	ATOMIZING NOZZLE LINE PRESSURE
PH	LP GOVERNOR INTERMEDIATE PRESSURE
PR	STARTER PUMP DELIVERY PRESSURE
PRP	PILOT ATOMIZING NOZZLE PURGE FLOW

PLATE VALVE (CONTROLS DUMP VALVE SERVO FLOW)
PLATE VALVE (SHUT-OFF VALVE SUPPLEMENTARY CONTROL)
PA
PXS
PB
PA
HP GOVERNOR
HP SHUT-OFF VALVE
PC
PT
START SOLENOID VALVE (ENERGIZED TO START)
FLOW CONTROL UNIT
SHUT-DOWN SOLENOID VALVE (DE-ENERGIZED FOR ENGINE RUN)
MANIFOLD AND FUEL ATOMIZING NOZZLES
PT
QUICK SHUT-DOWN VALVE
PB
DISTRIBUTION VALVES
PA
PB
PXS
PXS
S
S
S
PF
PH
PF
ENGINE FLOWMETER
PR PRP
PILOT ATOMIZING NOZZLES
DISTRIBUTION AND DUMP VALVE
ELECTRO PRESSURE CONTROL AND LP GOVERNOR
DUMP TO DRAINS TANK
MANIFOLD DUMP VALVE
PR PRP

R

Engine Fuel System Diagrammatic (Sheet 2 of 2)
Figure 009

opens the valve and a metered flow to the fuel atomizing nozzles, via the distribution block, commences. The shut-off valve opening movement opens the plate valves. which results in a servo pressure delivery to close the manifold dump valve in the distribution and dump valve and the opening of the holding flow path for the shut-off valve itself. The closing action of the dump valve in turn opens the fuel supply ports to the pilot nozzle assemblies.

There is a progressive rise in first stage pump pressure PF, and consequently throttle valve inlet pressure PA, as the engine speed increases. After a phased time lapse, during which the engine would have accelerated to idling speed under normal conditions, the starting pump is switched off and a switching action between the two non-return valves takes place. The first non-return valve closes and the second valve opens and allows pressures PF and PA to become effective in the fuel control loop. The engine will then stabilize at idling speed, set by the throttle lever, as the fuel flow control loop establishes the steady state condition.

During the acceleration phase of the starting cycle, the fuel control loop increases the fuel flow at a rate, determined by the control system, that keeps the engine within its safe operating range.

D. Fuel Controlling Engine Shut-down.

A normal engine shut-down occurs when the HP VALVE switch is selected SHUT and the shut-down solenoid valve is energized closed. The parallel fuel flow paths to spill return are closed by the solenoid valve and the HP shut-off valve pressure PC increases to throttle valve inlet pressure PA. Supplemented by the spring force, the pressure moves the piston and valve plunger towards the shut position and stops the fuel flow to the fuel nozzles. The effective plate valve, closed by the shut-off valve movement, ensures that the shut-off setting is held if the shut-off solenoid de-energizes and the valve opens.

Fuel pressure, directed to close the manifold dump valve when the HP shut-off valve opened, is now shut-off from the dump valve by its plate valve. The dump valve opens under its spring force and dumps residual fuel from the manifolds to the drains tank. The port servicing the pilot nozzle assemblies is closed by the valve movement.

The HP shut-off valve is actuated to shut-off fuel flow automatically as described in paragraph F if the quick shut-down valve is operated.

E. Overspeed Governing (Fig.004 and 005).

The engine LP and HP compressor shaft maximum speeds are limited by the engine control system during normal operation. Should an overspeed condition occur, then the engine speeds are limited to predetermined overspeed datum values by the governors of the fuel control system.

The HP shut-off valve is held open by servo throttle valve delivery pressure PT applied to one side of the shut-off valve piston and plunger assembly. Should a quantity of this fuel be bled away, the restricted supply will cause a pressure decrease in the chamber and the valve will be moved towards the closed position by HP shut-off valve pressure PC and the spring force.

Should an engine overspeed datum be exceeded, the affected governor would be activated and cause the shut-off valve to move in a closing sense and reduce the fuel flow to the engine. The reduced fuel flow limits the overspeed to the present datum value.

F. Quick Shut-down Operation.

The quick shut-down (emergency dump) valve will effect a rapid, automatic shut-down of the engine should an LP compressor shaft defect be signalled. A signal system reacts to an LP compressor shaft twist and operates the quick shut-down valve in the distribution block by means of a mechanical linkage as described in 76-20-00.

Should a defect signal be generated, the quick shut-down valve opens and diverts the fuel flow for the fuel atomizing nozzles through the distribution and dump valve outlet to the drains tank. (Ref. Fig. 010). There is an immediate cessation of fuel flow to the nozzles. At the same time, movement of the quick shut-down valve shuts off the fuel spill flow from the solenoid valves which is routed via the ports on the side of the valve. Stoppage of the fuel spill flow results in an HP shut-off valve action comparable to a normal shut-down sequence.

8. Reheat Fuel Controlling System Operation

A. General (Ref.Fig.011) .

The reheat system is made operative by use of the REHEAT selector switch in the flight compartment but reheat will not be initiated unless the engine is running within a specific safe operating range. The reheat initiation and operation are then controlled automatically by the control amplifier.

CR 31531/80A

PLATE VALVES CLOSING

START SOLENOID VALVE
(ENERGIZED OPEN)

MANIFOLD
DUMP VALVE
SERVO PRESSURE
SHUT-OFF

S

S

PB

PLUNGER MECHANISM (76-20-00)

SERVO SPILL
OUTLET CLOSED
HP SHUT-OFF
VALVE
CLOSING

MANIFOLD DRAIN
TO DUMP

QUICK SHUT-DOWN
(EMERGENCY DUMP)
VALVE OPERATED

MANIFOLD DUMP
VALVE (OPENING)

DUMP TO DRAINS TANK

CMR 73 20 00 0 KAMO

Quick Shut-down (Emergency Dump) Action
Figure 010

PF FIRST STAGE PUMP PRESSURE
PFR METERING VALVE OUTLET PRESSURE
PXS SPILL RETURN TO FIRST STAGE PUMP INLET

CR 31535/00B

GEARBOX
M
SPILL RETURN PXS
PF
FLOWMETER
PFR
REHEAT FUEL FILTER
PF (SERVO)
SPRAY RING
REHEAT INJECTION SYSTEM
AIR
SERVO VALVE
PFR
S
PFR
AIR FUEL SPILL
SHUT-OFF VALVE
S
REHEAT PURGE SOLENOID VALVE
REHEAT CONTROLLER
PURGE VALVE

CMR 73 20 00 0 LAMO

R

Reheat and Purge Control
Figure 011

Fuel is delivered from the first stage pump to the reheat controller via a filter and a flowmeter. The controller regulates the fuel flow to the injection system spray ring under the command of the reheat controller. The overall control by the controller, described in 76-00-00, is effective in the light-up, operation and shut-down phases.

B. Fuel Controller Operation (Ref. Fig. 012).

The reheat shut-off valve is controlled by means of a solenoid operated, servo valve. This valve directs filtered first stage pump delivery pressure PF to one side or the other of the shut-off valve piston which is spring-loaded towards the closed position. The needle type fuel metering valve is positioned, in response to control signals, by an electric motor.

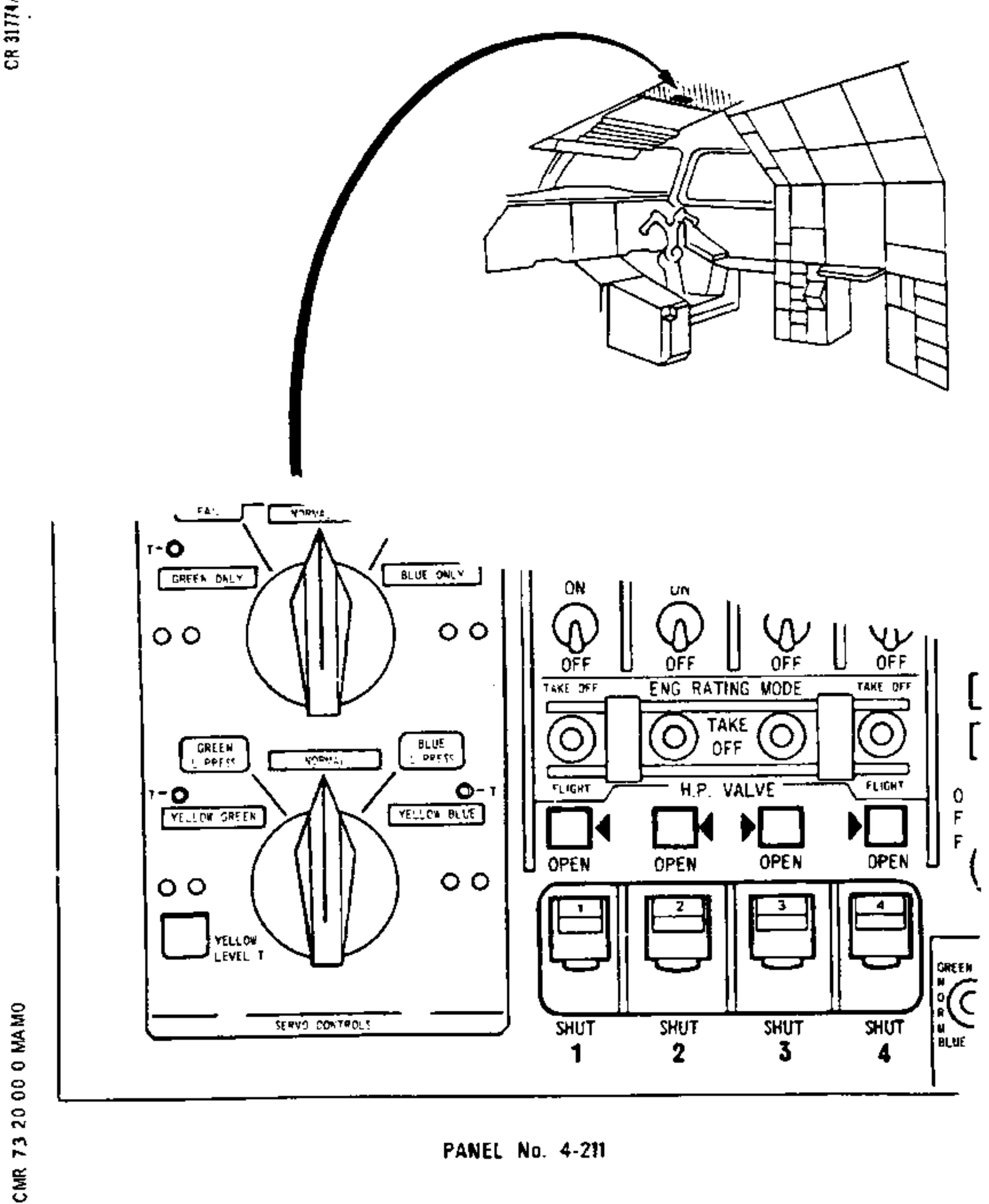
If reheat is selected, then, subject to engine control acceptability as described in 76-00-00, the servo valve will be activated and direct fuel at pressure PF to open the reheat shut-off valve. First stage pump delivery at pressure PF then passes to the metering valve inlet. The regulated fuel flow from the metering valve, at outlet pressure PFR, opens the purge valve and discharges through the forward facing holes of the spray ring. The spray ring/anvil assembly atomises the fuel and the flame holder stabilizes the flame. In the light-up sequence, the motor drives the metering valve following a law: reheat fuel flow Fr = k (engine fuel flow Fe). After light-up, the metering valve regulates the fuel flow following a law Fr/Fe depending on T1 temperature.

When shut-down is initiated, the solenoid of the servo valve is de-energized and moves to direct PF to the spring-loaded side of the shut-off valve and close it. At the same time, the metering valve is driven to the closed position. As the fuel flow ceases, the purge valve closes under its spring pressure and initiates a timed sequence of air purge which evacuates residual fuel from the reheat spray ring and its fuel supply tube.

C. Operation of Air Purge System (Ref. Fig. 013).

While reheat is operating, the purge valve is acted upon by the fuel pressure flow and held open against the spring force. The spring closes the valve when fuel pressure flow is shut-off. The main air purge ports are shut-off by the open valve and are exposed when the valve closes. Valve movement also initiates an electrical signal from the transducer for indication and control.

CR 31774/00A

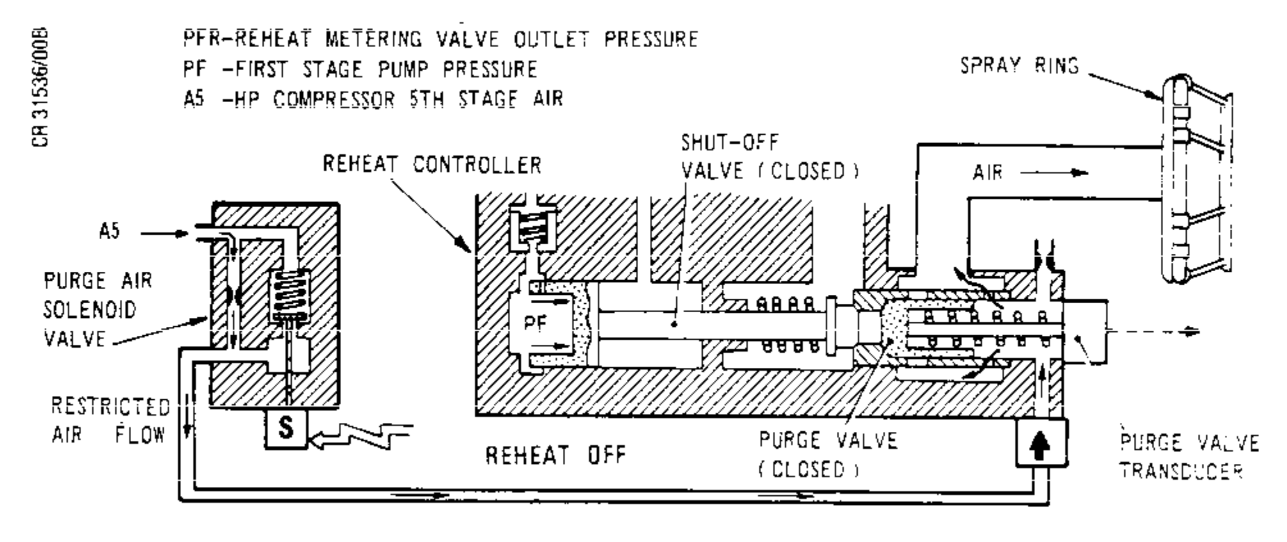


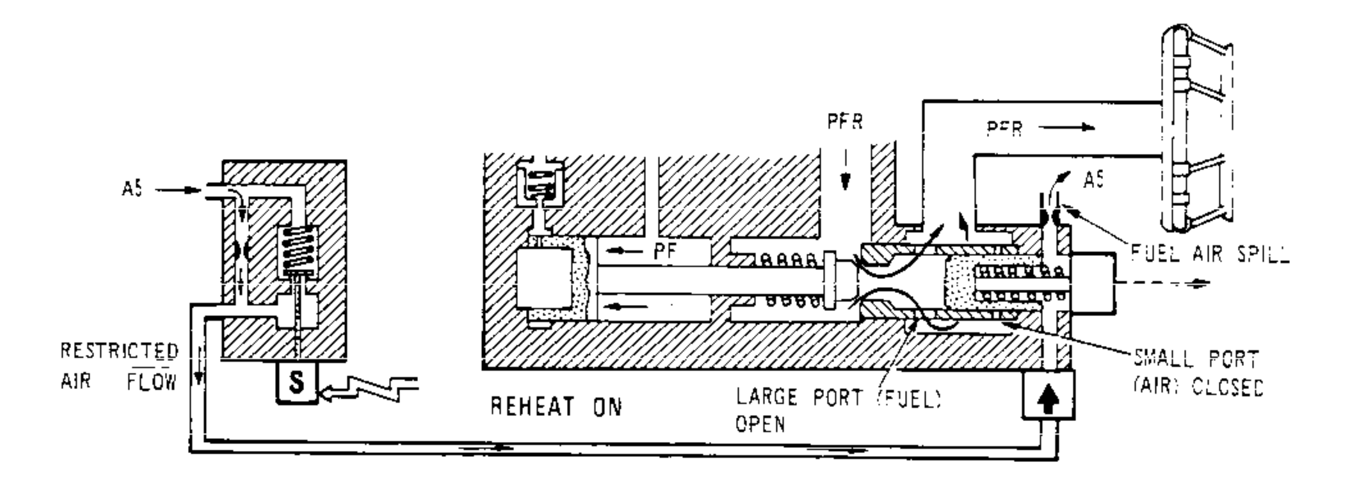
PANEL No. 4-211

CMR 73 20 00 0 MAMO

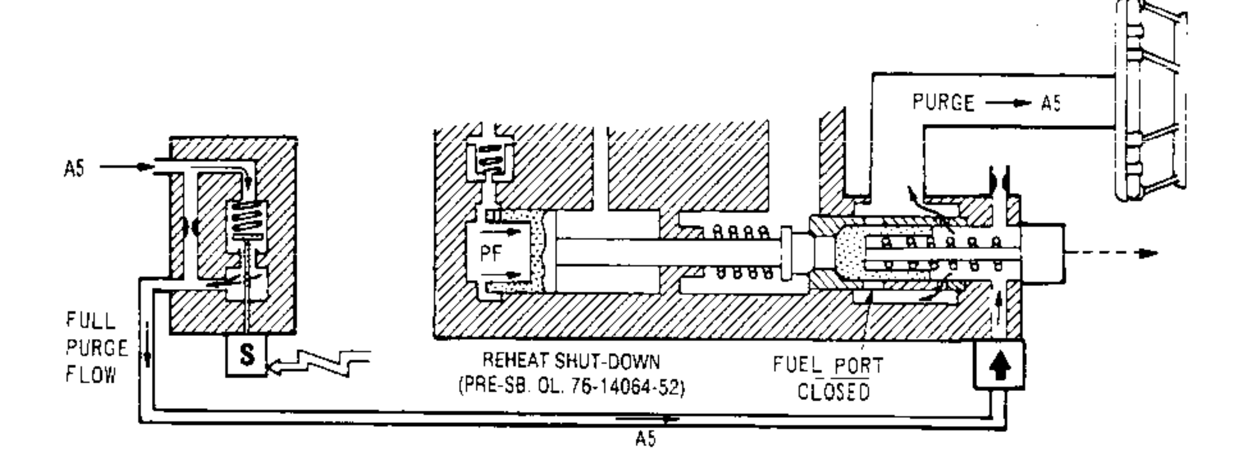
HP Shut-off Valve Control Panel
Figure 012

CR 31536/00B





R
R
R



Purge System Operation
Figure 013

When the engine is running without reheat, the purge air control valve is closed and a restricted flow of air by-passes the valve and passes through the purge valve ports into the fuel supply transfer pipe and through the internal purge bleed pipe to the exhaust diffuser.

With reheat on, the purge valve opens to pass fuel and close off the main purge air ports. The purge air control valve remains closed and all the restricted by-pass air flow now passes through the purge valve to the exhaust diffuser via the internal purge bleed pipe. Any fuel in the space behind the valve is purged to the diffuser with the air and an air pressure build up is obviated.

Immediately following shut-down of reheat a timed purge
R sequence of the system occurs (Pre-SB OL593-76-14064-52
R standard engines only). As reheat fuel flow ceases, the purge valve closes and exposes the main purge ports. The valve position transducer detects this move- ment and transmits a signal to the control system which energizes the purge air control valve open. Purging air flow then passes through the purge valve main ports and evacuates residual fuel from the fuel pipe and spray ring. At the end of the timed sequence, the control system de-energizes the air control valve, which closes to shut-off the main purge air flow and the system is again at the engine running, reheat off, condition.

CONTROLLING - REMOVAL/INSTALLATION

WARNING: WHENEVER THE HP VALVE CONTROL SWITCH IS TO BE SET TO OPEN, FIRST TRIP THE ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER TO PREVENT UNNECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMPERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General
This topic contains instructions for the removal and installation of the HP VALVE control switches on roof panel 4-211.

2. HP Valve Control Switch (Ref. Fig. 401)

CAUTION: ELECTROLUMINESCENT (EL) PANELS ARE SUSCEPTIBLE TO SCRATCHES AND CRACKS. ENSURE THAT TOOLS DO NOT DAMAGE THE POLISHED WALLS OF THE PANELS.

A. Prepare

(1) Isolate the electrical generation and power (Ref. 24-00-00, Servicing).

(2) Remove the gauging bars and rotary switch knobs, loosen the screws and withdraw the electroluminescent panel (Ref. 33-16-00, Remove/Installation).

(3) Release the quick-release fasteners securing panel 4-211 and allow the panel to hinge down sufficiently for access to the HP Valve control switches.

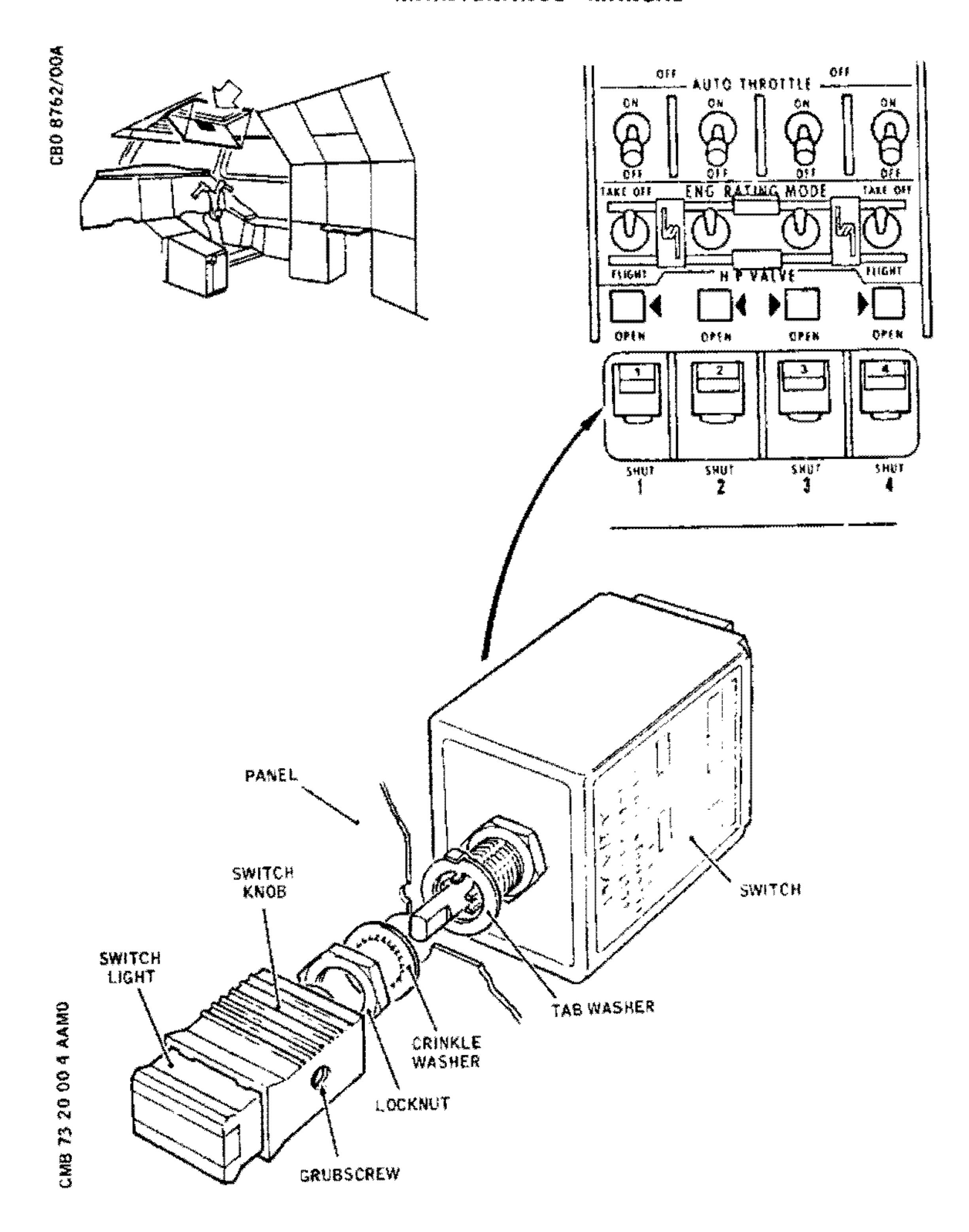
(4) If necessary, release cable loom ties.

B. Remove switch

(1) Release, if necessary, the cable loom ties for access to the terminals at the rear of the switch.

(2) Withdraw the pin inserts from the rear of the switch (Ref. Wiring Diagram Manual, 20-42-18).

(3) Remove the switch knob by inserting a small screw-driver in the side of the knob moulding and turning the grub screw counter clockwise until the knob is released.



HP Valve Control Switch - Installation
Figure 401

(4) Using a tubular spanner, remove the nut and crinkle washer from the front of the panel. Remove the switch and tab washer from the rear.

C. Install switch

(1) Comply with electrical safety precautions.

(2) Position the tab washer on the switch and insert the switch through the opening in the panel from the rear. Ensure that the outer lug on the tab washer engages with the locating hole in the panel.

(3) Secure the switch with the nut and crinkle washer.

(4) Connect the electrical cables to the switch ensuring that the connections are made in accordance with the cable identifications and applicable wiring diagram (Ref. WDM 73-21-00). Connect pin inserts (Ref. WDM 20-42-18).

(5) Renew any cable ties previously removed for access and reconnect the panel lighting (Ref. 33-16-00, Removal/Installation).

(6) Close the roof panel and fit the switch knob. Secure by means of the grub screw in the side of the knob moulding.

D. Conclusion

(1) Electrically isolate the T1 probe heater in the affected circuit by tripping the appropriate circuit breaker. Attach a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Eng1 T1 PROBE HTR SUP	13-215	1H542	C9
Eng2 T1 PROBE HTR SUP	14-215	2H542	E8
Eng3 T1 PROBE HTR SUP	14-216	3H542	C14

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Eng4 T1 PROBE HTR SUP	13-216	4H542	C11

(2) Restore the electrical power supply and carry out an operational test on the HP Valve control switch (Ref. 73-20-00, Adjustment/Test).

(3) Reset the circuit breakers previously tripped.

CONTROLLING - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00

WHENEVER AN HP VALVE CONTROL SWITCH IS TO BE SET TO OPEN, FIRST TRIP THE ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER TO PREVENT UNNECESSARY HEATER OPERATION. HEATERS WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMPERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

1. General

This topic contains instructions for the operational testing of the HP Valve control switch after installation on roof panel 4-211.

2. Operational Test of HP Valve Control Switch

A. Prepare

(1) Check that electrical power is available and that the appropriate T1 probe heater circuit breaker is tripped.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine 1 T1 PROBE HTR SUP	13-215	1H542	C9
Engine 2 T1 PROBE HTR SUP	14-215	2H542	E8
Engine 3 T1 PROBE HTR SUP	14-216	3H542	C14
Engine 4 T1 PROBE HTR SUPX	13-216	4H542	C11

B. Test

(1) Select HP VALVE switch SHUT and THROTTLE MASTER switch OFF.

(2) Select HP VALVE switch OPEN and check that the THROT

failure warning caption illuminates.

(3) Select HP Valve switch SHUT and check that the THROT failure warning extinguishes.

C. Conclusion

(1) Reset the T1 probe heater circuit breaker previously tripped.

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ENGINE FLOW CONTROL UNIT - DESCRIPTION AND OPERATION

1. General

The flow control unit, coupled with the second stage pump (Ref. 73-10-00) and the throttle valve actuator gearbox (Ref. 76-10-00) is mounted to the left-hand gearbox casing of the engine by a quick attach/detach coupling.

The flow control unit meters the flow of fuel from the pumping
R system to the engine fuel pressure atomizing nozzle assemb-
R lies to suit engine requirements. This metering is achiev-
R ed by means of a throttle valve which is positioned by the
R engine electronic control system. Changes of pressure
R across the throttle valve are sensed by a pressure drop
R unit which positions the servo throttle valve. The servo
R throttle controls the fuel flow by regulating the
R throttle valve pressure difference. Fuel is supplied to the
R engine distribution system via the shut-off valve which
R also works is conjunction with governors on the LP and HP
R compressor shafts to provide overspeed protection.

The throttle valve and pressure drop unit are rotated to reduce friction and the drive for the internal rotating components is taken through a drive shaft to a train of gear; carbon bearings are used to support a number of the rotating components.

To prevent pressurized fuel spraying into the engine bay from a seal failure, a system of double sealing is used. The annulus between each seal is connected, through drillings in the unit, to a common drain connection in the base of the unit.

2. Description (Ref. Fig. 001, 002 and 003)

The flow control unit consists of:

Drive shaft and gears.
Throttle valve.
Pressure drop unit.
Servo throttle valve.
Shut-off valve.
HP governor.
Solenoid valves.
Electro pressure control.
Air actuator valve.

A. Drive Shaft and Gears.

A splined input shaft engages with the engine gear casing drive and, a gear wheel, on the inner end of the shaft,

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transmits drive to an idler gear which in turn drives the HP shaft overspeed governor. A pinion of the idler gear transmits drive to a second idler gear, which in turn through its pinion, transmits drive to a layshaft; the layshaft transmits drive to the throttle valve and pressure drop unit. On the input shaft, a pair of rotating seals, prevent oil leakage from the engine gearbox and fuel leakage from the FCU. The space between the seals connect to the engine seal failure drains system.

B. Throttle Valve.

The throttle valve consists of a drilled sleeve and a rotating plunger; the plunger is positioned within the sleeve by a rack and pinion operated by the actuator gearbox responding to signals from the electronic control.

One end of the sleeve is drilled with a set of main fuel metering holes which become operative when the throttle lever has moved to 28 deg or above. Midway along the sleeve a second profile of holes controls the idling fuel flow which become operative when the throttle valve is moved from the 0 deg position.

As a result of keeping the physical size of the throttle as small as possible, a low pressure drop from throttle valve inlet pressure to throttle valve outlet pressure exists across the main profile at low flows and will be replaced by a higher pressure drop at high flows. A triangular shaped port in the sleeve in series with a fixed orifice creates a potentiometer pressure, the value of which at any steady conditions, will provide a constant pressure difference across the potentiometer profile.

C. Pressure Drop Unit.

This is a rotating spool valve, one end is subjected to potentiometer pressure and at the other end subjected to spring and throttle valve delivery pressure.

A metering edge on the spool traverses a drilled profile which is in series with a fixed orifice completing a fuel potentiometer from first stage pump to suction pressure. The intermediate pressure formed by this potentiometer is called servo pressure. Thus any variation in the potentiometer profile pressure difference will be reflected in a change of servo pressure.

D. Servo Throttle Valve.

This unit consists of a piston operating within a ported

SECOND STAGE MOUNTING FACE
DRAINS TUBE
LIFTING TUBE
CR 31769 00A
MAIN INLET
CMR 73 21 01 0 AAMO
OUTLET TO DISTRIBUTION AND DUMP VALVE
MINIMUM FLOW (UNDER CAPNUT)
THROTTLE VALVE ACTUATOR DRIVE COUPLING
DATUM RESET
THROTTLE VALVE ACTUATOR GEARBOX MOUNTING FACE
QUICK SHUT-DOWN (EMERGENCY DUMP) CONNECTION
SOLENOID No. 2 (SHUT-DOWN VALVE)
SOLENOID No. 1 (START VALVE)

Flow Control Unit Type FCU115
(Drive-end View)
Figure 001

QUICK ATTACH/DETACH COUPLING

SPILL RETURN TO FIRST STAGE PUMP INLET

SECOND STAGE PUMP MOUNTING FACE

CR 31770 00A

DRIVE SHAFT

CMR 73 21 01 0 BAMO

ELECTRO-PRESSURE CONTROL

AIR ACTUATOR VALVE

SPILL RETURN TO FIRST STAGE PUMP INLET

Flow Control Unit Type FCU115
(Rear View)
Figure 002

CR 31771/00A

GOVERNOR IDLER GEAR

A

INPUT GEAR SHAFT

HP SHAFT OVERSPEED GOVERNOR

DATUM RESET

LAYSHAFT IDLER GEAR

LAYSHAFT

PRESSURE-DROP UNIT

A

90°

H

L

ACTUATOR GEARBOX DRIVE

THROTTLE VALVE

CMR 73 21 01 0 CAMO

Sectioned Gear Train Assembly
Figure 003

sleeve. Servo pressure is fed to one side of the piston and balanced on the other side by an intermediate pressure formed by a potentiometer with a fixed orifice. The unit is situated immediately downstream of the throttle valve, fuel flow to the engine flows in at the centre of the piston and any movement of the piston will directly throttle the main flow; in so doing, it controls the pressure difference across the throttle valve and hence across the potentiometer profile which is maintained at a constant value of 20 psi.

E. Shut-off Valve.

The shut-off valve consists of a differential area piston and plunger assembly operating within a ported sleeve. The underside of the piston is subjected to servo throttle valve delivery pressure and fuel sprayer pressure acts on the area of the plunger; these two pressures are balanced by reduced pump delivery pressure and a spring force acting on top of the piston.

A non-return valve in the piston opens to allow rapid closure of the shut-off valve if the governors come into operation.

A projection on the plunger protrudes from the piston to operate two plate valves, one of which supplies fuel to the SHUT-DOWN solenoid, the other valve provides a fuel pressure term to the dump valve.

F. HP Shaft Overspeed Governor.

The governor consists of a set of three flyweights mounted on a carrier and is rotated by means of a gear train from the drive shaft. Each of the weights has an arm that bears against a profiled plunger which will move when the overspeed datum is reached and spill pressure from the underside of the shut-off valve that, in turn, progressively closes so as to reduce fuel flow to the engine. Since the governor has no effect during normal running conditions, it is necessary during ground testing to simulate the overspeed conditions. This is achieved by operating a datum reset device which reduces the spring-loading of the profiled plunger within the governor.

The datum reset device consists mainly of an adjusting screw contained within a housing which may be selected to one of two positions, one position gives normal loading and the other position the reduced loading required for ground adjustment purposes.

A special tool is used to unlock the adjusting screw housing and allow the governor spring to expand hence reducing the load applied in opposition to the centrifugal component of the governor. With the datum reset in this position, the special tool is automatically prevented from becoming disengaged; this ensures that the access doors on an aircraft installed engine cannot be closed when the datum tool is fitted hence the aircraft cannot be flown with the engine governor set in the low datum postion. Removal of the tool automatically resets the unit in the high datum position for normal engine operation.

G. Solenoid Valves No.1 and No.2.

These valves function when the engine is started and shut down and are controlled by the operation of HP shut-off valve switch. Each valve consists of a solenoid actuated plate valve which operates on an orifice; No.1 solenoid plate valve is spring-loaded to the normally closed position whilst No.2 is spring-loaded to the normally open position. When the switch is selected to ON, the start solenoid (No.1) is energized and moves to its open position the shut-down solenoid (No.2) is de-energized and moves to its open position by spring pressure. Conversely when the switch is selected to OFF the start solenoid is de-energized and closes by spring pressure, the shut-down solenoid is energized and moves to the closed position.

H. Electro Pressure Control (LPC).

The electro-pressure control contains the LP shaft over-speed governor which is electrically actuated. A signal generated by the LP compressor is amplified and presented to the solenoid of the electro-pressure control. Movement of the solenoid core, transmitted through a lever arm, causes a plate valve to become unseated from a profiled servo piston operating within a sleeve which controls a spill from the shut-off valve servo.

J. Air Actuator Valve (AAV).

This unit is bolted to the flow control unit and its function is to position a butterfly valve to control P2 air supply to the air turbine of the second stage pump. The air actuator valve consists of a differential area piston linked to the butterfly valve of the second stage pump. One side of the piston is
R subjected to fuel atomizing nozzle pressure and this is
R balanced by AAV intermediate pressure together with a
R spring force.

A transient loss of first stage pump pressure would off-load the second stage pump and possibly give rise to second stage pump overspeed; such a possibility is anticipated by the low pressure sensing valve. First stage pump pressure rise is sensed by a piston which moves against spring pressure to seat a plate valve. If the first stage pump pressure decreases, the piston moves under the influence of its spring, decreasing the spring-loading of the plate valve, it opens to allow fuel sprayer line pressure to bleed to the first stage pump inlet. This loss of fuel sprayer line pressure will be felt by the differential area piston of the air actuator valve and it will move to the closed position, closing the butterfly valve and shutting down the second stage pump.

3. Principle of Operation (Ref. Fig. 004)

A. Starting.

Engine start is made with the pilots throttle lever selecting idle but the throttle valve is capable of being closed automatically, at any time during the starting cycle, by the electrical control system should the fuel requirement be reduced (Ref.76-10-00). The minimum flow in the circumstances would be controlled by the starting flow bypass line. This line is provided with a flow adjustment.

The electric starter pump (Ref.73-10-00) is positioned in series with the first stage pump and is capable of supplying engine requirements up to idling flow. The first stage pump would be supplying the engine by the time idling rpm is reached. The starter pump outlet is fed to a non-return valve (No.1) which opens to allow flow to the idling profile, potentiometer profile and starting flow bypass of the throttle valve. A further line from the starter pump output supplies the pressure drop unit, via a restrictor, with servo pressure.

As the starter pump pressure increases, servo pressure increases and opens the servo throttle valve allowing flow from the profiles to continue through the system.

When the shut-off valve is selected to OPEN, the start solenoid is energized to the open position. The shut-down solenoid remains in the open position by spring pressure. Fuel flows through the energized start solenoid, and as a result, the pump delivery pressure is reduced to HP valve pressure by the restrictor. To balance the forces acting across the shut-off valve piston, the valve moves to some

CR 31772/00A

LOW PRESSURE SENSING VALVE

SPILL RETURN OUTLET

INLET FROM FIRST STAGE AND SECOND STAGE PUMP

AIR TO SECOND STAGE PUMP

NON-RETURN VALVE No.1

NON-RETURN VALVE No.2

PRESSURE DROP VALVE

SPILL RETURN OUTLET

OPEN

AIR ACTUATOR VALVE (A.A.V.)

STARTING FLOW (ADJUSTABLE)

THROTTLE VALVE

CMR 73 21 01 0 DAMA

INLET FROM ELECTRIC STARTER PUMP AND FIRST STAGE PUMP

PRESSURE DROP UNIT

SERVO THROTTLE VALVE

Operational Diagram of Flow Control Unit
(Sheet 1 of 2)
Figure 004

H P SHAFT OVERSPEED GOVERNOR
PLATE VALVES
START SOLENOID (No.1) (ENERGISED OPEN)
SHUT-DOWN SOLENOID (No.2)
SERVO OUTLET TO MANIFOLD DUMP VALVE
CR 31773/00B
PA
PC
PB
PXS
PT
PF
PH
SPILL OUTLET TO DISTRIBUTION AND DUMP VALVE
H P SHUT-OFF VALVE
OUTLET TO FUEL ATOMIZING NOZZLES
CMR 73 21 01 0 DAMB
L P SHAFT OVERSPEED GOVERNOR

PA	THROTTLE VALVE INLET PRESSURE
PXS	SPILL TO FIRST STAGE PUMP INLET
PSC	SERVO THROTTLE VALVE INTERMEDIATE PRESSURE
PP	THROTTLE VALVE POTENTIOMETER PRESSURE
PB	ATOMIZING NOZZLE LINE PRESSURE
PFX	AIR ACTUATOR VALVE INTERMEDIATE PRESSURE
PD	THROTTLE VALVE OUTLET PRESSURE
PF	FIRST STAGE PUMP PRESSURE
PT	SERVO THROTTLE VALVE DELIVERY PRESSURE
PC	H P SHUT-OFF VALVE PRESSURE
PSV	SERVO PRESSURE
PH	L P GOVERNOR INTERMEDIATE PRESSURE

Operational Diagram of Flow Control Unit
(Sheet 2 of 2)
Figure 004

open position. The mechanically operated plate valve opens a path in parallel with the energized start solenoid, allowing fuel to flow through the open shut-down solenoid. The shut-off valve will now remain in the selected position if the electrical supply to the solenoid valve fails.

Following light-up, the starter pump pressure is nullified, and the engine requirement is satisfied entirely by the first stage pump. This results in closure of non-return valve No.1 and the opening of non-return valve No.2 to allow first stage pump pressure at the throttle valve profiles.

The first stage pump (Ref.73-10-00) is capable, at a constant speed, of a higher flow rate with reduced throttling. In these circumstances the pressure difference across it will remain, within the limits of the pump capacity, approximately constant.

B. Acceleration.

As the throttle valve is opened, the pressure difference across both it and the potentiometer profile will reduce causing the pressure drop unit to decrease the bleed of servo pressure to the first stage pump inlet. Servo pressure will now increase in value causing the servo throttle valve to open as it does so. This action will provide an immediate increase of flow to the engine.

As the engine accelerates with the increase in flow, the pressure difference across the throttle valve will rise and that across the potentiometer profile will be restored to approximately 20 psi. The pressure drop unit will establish a new position which, together with the increase in first stage pump pressure, will maintain servo pressure and the servo throttle valve in its new position.

The second stage pump is situated downstream of the first stage pump (Ref.73-10-00). Its speed is controlled by the butterfly valve linked to the differential area piston of the air actuator valve.

At high flows when the limiting output pressure of the first stage pump has been reached, the overall pressure
R drop of the unit will be such that fuel nozzle line
R pressure acting on the large area of the AAV differ-
R ential piston will be greater that the combined
R pressure and spring pressure acting on the smaller
R area of the piston. The balance of forces across
R the piston is upset and the piston moves to open the
R air throttle. This action introduces the second

R stage pump which restores the throttle valve inlet
R pressure.

As the fuel demand reduces with increasing altitude the closure of the throttle valve raises the system pressure difference. The differential area piston moves to close the air throttle unit, the second stage pump ceases to function and the system operates within the capacity of the first stage pump.

A bypass valve opens to allow fuel to bypass the impeller of the second stage pump when it is inoperative.

C. Overspeed Governors.

HP shaft governor.

If the overspeed datum is exceeded, the increase in flyweight force causes a plunger to move and spill pressure from the underside of the differential - area piston of the shut-off valve which will move towards the closed position thereby reducing the fuel flow to the engine.

LP shaft governor.

If the overspeed datum is exceeded, the output from the speed probe unit which is an amplified d.c. signal, is supplied to the solenoid of an electro-pressure control. Movement of the solenoid core, transmitted through the lever arm, causes a plate valve to become unseated. Fuel bleed, via a restrictor and the bore of the servo piston plunger to the first stage pump inlet. A pressure difference now exists across the servo piston which moves to follow up the plate valve.

A profile cut on the plunger allows servo throttle valve delivery pressure to spill through a restrictor to first stage pump inlet. This opens a non-return valve to spill fuel from the underside of the shut-off valve piston through the governor to the first stage pump inlet. The pressure of fuel beneath the shut-off valve piston will now reduce as the supply to the chamber is restricted, thus causing the shut-off valve to move towards the closed position thereby reducing the fuel flow to the engine.

D. Shut-down.

When the shut-off valve is selected SHUT, the shut-down solenoid is energized and closed. The start solenoid is de-energized and also closed under the influence of its

spring. Pump pressure builds up and aids spring pressure to move the shut-off valve piston and plunger assembly towards the shut postion. Movement of the plunger operates a plate valve which isolates the fuel supply to the shut-down solenoid. If the electrical supply to the shut-down solenoid fails, or is switched off, the shut-off valve will remain in the closed position. The other plate valve controls a supply of fuel to the dump valve.

ENGINE FLOW CONTROL UNIT - REMOVAL/INSTALLATION

1. General

The flow control unit (FCU) is removed complete with the second stage pump as an assembly and the units separated after removal.

If removal/installation of the FCU is necessary because of a drive shaft failure, refer to 72-62-04, Removal/Installation, for the action required.

Procedures for the Removal/Installation of the Start and/or Shut-down Solenoid Valve(s), as separate items, are given in paragraph 11.

The following procedures apply to both pre and S.B.OL.593-72-8458-161 and 73-43, 44, 48 and 8637-61 standard engines. R

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Air pressure supply capable of 30 psig.

Pressure test and inhibiting rig (PTIR) ...	PE.17988
Air bleed tube	PE.22898
Drain tube (Pre S.B.OL.593-73-1 drain valve)	PE.34076
Drain tube (S.B.OL.593-73-1 drain valve) ...	PE.26796
Drain tube for heater and filter drain valve...	PE.21970
Lifting equipment, for FCU/second stage pump assembly, comprising:	
Lifting tube	PE.29916
Support plate	PE.29836
Adapter	PE.27949
Mini-hoist winch	PE.15870
Extension tube, for mini-hoist winch ...	PE.15749
Lifting tool, for air duct detachment ...	PE.29347

Drift, for assembly and removal of quick attach/detach coupling	PE.3778
T-Spanner assembly, for quick attach/ detach coupling locking bolt	S3S 1234800
Circuit breaker safety clip	-

Lucas tools and equipment, comprising:

R

Connection	RSK.1143/15
Connection	RSK.1146/12
Holder	T.446403
Key spanner	T.446404
Pressure test equipment	T.474242

3. Approved Materials

R None.

4. FCU/Pump Assembly

A. Prepare to Remove FCU/Pump Assembly.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay doors on engines No.1 and No.3 and engine bay lower doors on engines No.2 and No.4 (Ref.71-00-00, Servicing).

WARNING: WHENEVER ENGINE HP CONTROL CIRCUIT BREAKER IS TO BE TRIPPED OR HP VALVE SWITCH IS TO BE SET TO OPEN, FIRST TRIP ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER AND PREVENT UNNECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMPERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
START FUEL PUMP SUP	1-213	1Q812	J6
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
T1 PROBE HEATER SUP	13-215	1H542	C9
HP VALVE CONT	3-213	1K131	C1
N1 GOVERNOR AMP SUP	1-213	1K161	C1
MAIN THROT SUP	2-213	1K1	F12
MAIN THROT CONT	3-213	1K3	A1
ALTN THROT SUP	14-215	1K2	G12
ALTN THROT CONT	15-216	1K4	E8
NO.4 BEARING O/HEAT AMP SUP	5-213	1E451	E1
FUEL RECIRC VALVE CONT	3-213	1Q791	G1
FUEL FLOW IND SUP	14-215	E471	C15
FQ1 CONT PNL WARN & FUEL FLOW TEST SUP	1-213	Q1407	J17
Engine No.2			
START FUEL PUMP SUP	1-213	2Q812	K6
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19
T1 PROBE HEATER SUP	14-215	3H542	E8
HP VALVE CONT	1-213	2K131	C3
N1 GOVERNOR AMP SUP	3-213	2K161	D3
MAIN THROT SUP	1-213	2K3	A3
MAIN THROT CONT	2-213	2K1	C12
ALTN THROT SUP	13-215	2K2	F14
ALTN THROT CONT	15-215	2K4	F15
NO.4 BEARING O/HEAT	1-213	2E451	D5

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
AMP SUP			
FUEL RECIRC VALVE CONT	1-213	2Q791	E5
FUEL FLOW IND SUP	13-215	E472	B17
FQ1 CONT PNL WARN & FUEL FLOW TEST SUP	1-213	Q1407	J17
<u>Engine No.3</u>			
START FUEL PUMP SUP	1-213	3Q812	L6
LP VALVE SUP 1	15-216	3Q1	F1
LP VALVE SUP 2	15-215	3Q2	C20
T1 PROBE HEATER SUP	14-216	3H542	C14
HP VALVE CONT	1-213	3K131	C4
N1 GOVERNOR AMP SUP	3-213	3K161	D4
MAIN THROT SUP	1-213	3K3	A4
MAIN THROT CONT	2=213	3K1	C13
ALTN THROT SUP	13-216	3K2	C5
ALTN THROT CONT	15-215	3K4	F16
NO.4 BEARING O/HEAT AMP SUP	1-213	3E451	D6
FUEL RECIRC VALVE CONT	1-213	3Q791	E6
FUEL FLOW IND SUP	13-216	E564	D4
FQ1 CONT PNL WARN & FUEL FLOW TEST SUP	1-213	Q1407	J17
<u>Engine No.4</u>			
START FUEL PUMP SUP	1-213	4Q812	M6
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-
T1 PROBE HEATER SUP	13-216	4H542	C11
HP VALVE CONT	3-213	4K131	C2
N1 GOVERNOR AMP SUP	1-213	4K161	C2
MAIN THROT SUP	2-213	4K1	F13

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
MAIN THROT CONT	3-213	4K3	A2
ALTN THROT SUP	14-216	4K2	C7
ALTN THROT CONT	15-216	4K4	F9
NO.4 BEARING O/HEAT AMP SUP	5-213	4E451	E2
FUEL RECIRC VALVE CONT	3-213	4Q791	G2
FUEL FLOW IND SUP	14-216	E525	B3
FQ1 CONT PNL WARN & FUEL FLOW TEST SUP	1-213	Q1407	J17

Circuit Breakers
Table 401 (Concluded)

B. Drain the Inlet Elbow and FCU Section of the Fuel System.

(1) Open bleed valve to expedite draining.

(2) Use drain tube PE.34076 (Pre S.B.OL.593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE.21970 at the fuel heater and filter drain valve. Direct free ends of drain tubes into a container and drain the system upstream of the FCU.

(3) Remove the blanking ferrules at the starting pump and the fuel tube flange at the engine fuel flow-meter inlet and drain the system downstream of the FCU and oil cooler.

(4) When drain ceases, remove drain tubes and close the bleed valve. Install the blanking ferrules at the two drain points torque-tightened to between 190 and 210 lbf in. (21,5 and 23,5 N.m) with lubricant A applied. Wire-lock union nuts.

NOTE: Discard drained fuel or inhibiting fluid.

C. Remove Outlet Section of Oil Tank Vent Tube (Ref. Fig. 401).

(1) Remove three nuts and detach sealing plate.

(2) Disconnect vent and drain tube union bolts from vent tube manifold elbow.

(3) Remove section of air intake case adapter to outlet seal plate vent tube - tube joint to manifold vent tube elbow.

(a) Remove bolt, flat washer and nut then detach clamps from the LP and HP compressors thrust bearings oil scavenge tube thermocouple adapter.

(b) Support tube and unscrew union nut at tube joint. Remove tube from engine.

(4) Remove section of air starter air vent tube - tube joint to manifold elbow. Support tube and unscrew union nut at tube joint. Remove tube from engine.

(5) Remove nut and bolt securing vent tube manifold elbow to support bracket.

(6) Remove three nuts and bolts at tube joint flange, detach bracket and remove tube and gasket from engine.

D. Remove Oil Scavenge Tubes (Ref. Fig. 402).

(1) Remove LP and HP compressor thrust bearings oil scavenge tube.

(a) Drain oil from left-hand gearbox (Ref. 72-01-00, Servicing).

(b) Detach electrical harness support bracket from tube.

(c) Remove bolts to detach tube flange from main oil pump.

(d) Support tube and remove bolts to detach tube flange and support bracket from pulse probe drive and housing. Remove tube and gaskets from engine.

(2) On No.2 and No.4 engines remove section of HP turbine bearing oil scavenge tube - tube joint to main oil pump.

(a) Position container to collect oil drainage.

CR 30437/00A

GASKET
D
SUPPORT BRACKET
C
OIL TANK VENT TUBE
D
AIR INTAKE CASE VENT TUBE
SEALING PLATE
A
AIR STARTER AIR VENT TUBE
B
C
CMR 73 21 01 4 AAM0
SUPPORT BRACKET
MANIFOLD ELBOW VENT TUBE
A
IDG GLAND DRAIN TUBE
B
HYDRAULIC PUMPS GLAND DRAIN TUBE
SEALING PLATE DETACHED

Vent and Drain Tubes Removal/Installation
Figure 401

CR 30438 / 00A

GASKET

A B

ELECTRICAL HARNESS SUPPORT BRACKET

MAIN OIL PUMP

C

A

HP TURBINE BEARING OIL SCAVENGE TUBE

B

D

LP AND HP COMPRESSOR THRUST BEARINGS OIL SCAVENGE TUBE

PULSE PROBE DRIVE AND HOUSING

E

C

D

HP TURBINE BEARING OIL OUTLET THERMOMETER

ELECTRICAL HARNESS SUPPORT BRACKET

E

CMR 73 21 01 4 BAMO

Oil Scavenge Tubes Removal/Installation
Figure 402

(b) Unscrew union nut at tube joint.

(c) Disconnect the electrical lead connection from the oil outlet thermometer in the HP turbine bearing oil feed tube to give added spanner clearance for the union nut.

(d) Support tube and remove bolts to detach tube flange from main oil pump. Remove tube and gasket from engine.

E. Disconnect Electrical Leads (Ref. Fig. 403).

(1) HP pulse probe - disconnect lead end plug from probe.

(2) Start and shut down solenoid valves - disconnect lead end plugs from the two valves.

(3) LP governor - disconnect lead end plug from connection on FCU.

(4) Engine fuel flowmeter disconnect lead end plug from connection on flowmeter.

F. Detach Electrical Harness and Drains System (Ref. Fig. 404).

(1) Detach electrical harness clamps from brackets on second stage pump and main oil pump.

(2) Detach seal failure drains system three-way connector from bracket on second stage pump.

G. Remove Actuator Gearbox (TV).

(1) Remove actuator gearbox (Ref.76-11-01, Removal/ Installation).

H. Remove Gland Drain Tubes (Ref. Fig. 405).

(1) Remove first stage fuel pump/FCU gland drain tube.

(a) Detach clamp assembly securing tube to mounting bracket at main oil pump flange.

(b) Remove fluid passage bolt and two sealing washers securing tube connection to first stage fuel pump.

(c) Support tube and disconnect union nuts from

FCU union connection and second stage pump fuel drain tube.

(d) Remove tube from engine.

(2) Remove fuel drain tube second stage pump to drains tank.

(a) Detach clamp assembly.

(b) Unscrew tube union nut at drains tank.

(c) Support tube and remove bolts securing tube flange to second stage pump.

(d) Remove tube and seal plate from engine.

J. Remove Fuel Tube - FCU to Engine Fuel Flowmeter (Ref. Fig. 406).

(1) Detach servo fuel tube from flange at flowmeter end of tube.

(2) Remove nuts and bolts at flowmeter end of tube and detach nut plate assembly. Withdraw seal plate.

(3) Remove nuts and bolts to detach support bracket and electrical lead clamp from tube flange at flowmeter end.

(4) Support tube and remove bolts securing tube to elbow at FCU end of tube. Withdraw seal plate and remove tube from engine.

K. Remove/Detach Fuel Tube Sections - Reheat Controller and FCU Spill to First Stage Pump Inlet Elbow (Ref. Fig. 406).

(1) Remove tube section - connection block on reheat fuel controller to multi-connection centre assembly rear union connection.

(a) Detach tube clamp assembly.

(b) Unscrew union nut securing tube section to multi-connection centre assembly rear union connection.

(c) Support tube and unscrew union nut securing tube to connection block on reheat fuel

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CR 30439/00A

FLOW CONTROL UNIT
LP GOVERNOR
START AND SHUT-DOWN SOLENOIDS
HP PULSE PROBE
ENGINE FUEL FLOWMETER
ACTUATOR GEARBOX

CMR 73 21 01 4 CAM0

Locations of Electrical Connections
Figure 403

CR 30440 / 00A

A
B
C
MAIN OIL PUMP
ELECTRICAL HARNESS

CMR 73 21 01 4 DAM0

SEAL FAILURE DRAINS SYSTEM
THREE WAY CONNECTOR
SUPPORT BRACKET ON
FCU / PUMP FLANGE
A
B
C

Electrical Harness Clipping and Drains System
Three Way Connector Attachment
Figure 404

R

controller. Remove tube section from engine.

(2) Detach multi-connection centre assembly tube section.

(a) Unscrew union nut at centre assembly front union connection and detach assembly from tube front sections.

(b) Remove nuts and bolts securing centre assembly to support bracket at second stage pump.

L. Remove Support Bracket on Second Stage Pump (Ref. Fig. 406) (detail D).

(1) Remove nut and bolt securing clamps, FCU to engine fuel flowmeter tube and reheat flowmeter electrical lead, to support bracket.

(2) Remove bolts securing bracket to second stage pump and remove bracket.

M. On No.2 and No.4 Engines Remove Engine Flowmeter.

(1) Support flowmeter and remove bolts and washers securing the unit to the distribution and dump valve.

(2) Remove flowmeter and seal plate.

N. Remove Fuel Tubes (Ref. Fig. 406).

(1) Remove servo fuel tube section - FCU to distribution and dump valve rear face.

(a) Detach tube clamp assembly.

(b) Remove bolts securing tube flange to FCU and withdraw seal plate.

(c) Support tube and unscrew union nut at tube joint.

(d) Remove tube section from engine.

(2) Remove fuel tube section - starter pump to FCU.

(a) Unscrew union nuts at FCU and tube joint.

(b) Remove tube from engine.

CR 30441/00A

A

B

C

D

E

F

FIRST STAGE PUMP

FIRST STAGE PUMP/FCU GLAND DRAIN

SECOND STAGE PUMP TO DRAINS TANK TUBE

MAIN OIL PUMP

FCU UNION CONNECTION

CMR 73 21 01 4 EAM10

A B C

SECOND STAGE PUMP

SEAL PLATE

DRAIN TUBE CONNECTION

DRAINS TANK

D E F

Gland Drain Tubes
Figure 405

CR 30442/00A

ELBOW

A

B

FLOW CONTROL UNIT

ENGINE FLOWMETER

FCU TO
ENGINE FLOWMETER

D

REHEAT CONTROLLER AND
FCU SPILL TO FIRST
STAGE PUMP INLET ELBOW

CONNECTION BLOCK

REHEAT FUEL CONTROLLER

C

FIRST STAGE FUEL PUMP
TO SECOND STAGE PUMP

CMR 73 21 01 4 FAMA

CONNECTIONS TO FCU

SUPPORT BRACKET

SECOND STAGE
PUMP INLET ELBOW

MULTI-CONNECTION
CENTRE ASSEMBLY

D

C

FRONT UNION
CONNECTION

Fuel Tubes Removal/Installation (Sheet 1 of 2)
Figure 406

CR 30443/00A

FILTER HOUSING

E

OIL TANK VENT TUBE

F

FCU TO DISTRIBUTION AND DUMP VALVE REAR FACE TUBE SECTIONS

FCU TO DISTRIBUTION AND DUMP VALVE TUBE

STARTER PUMP TO FCU TUBE SECTION

E F G H J

LOCATED AT ◓ SEE SHEET 1

CMR 73 21 01 4 FAMB

SEAL PLATE

J

SEAL PLATE

H

SEAL PLATE

G

Fuel Tubes Removal/Installation (Sheet 2 of 2)
Figure 406

CR 30444 00B

AIR DUCT

A

FCU

SECOND STAGE PUMP

LIFTING TOOL

SEALING RING ASSEMBLY

A

CMR 73 21 01 4 GAMO

Second Stage Pump Air Duct Attachment
R Figure 407

(3) Remove servo fuel tube - FCU to distribution and dump valve.

(a) Remove bolts securing tube flange to FCU and withdraw seal plate.

(b) Remove bolts securing tube flange to distribution and dump valve and withdraw seal plate.

(c) Remove tube from engine.

P. Detach Fuel Tube at Second Stage Pump Inlet Elbow (Ref. Fig. 406).

(1) Remove bolts securing tube flange to inlet elbow of second stage pump.

(2) Withdraw seal plate.

Q. Detach Air Duct From Second Stage Pump (Ref. Fig. 407).

(1) Remove nut and flatwasher from each of the two double ended bolts at pump flange.

(2) Use lifting tool and push duct upward to detach from pump so as to provide FCU/pump assembly removal clearance.

(3) Rotate duct until one lug locates with oil cooler flange.

R. Install Lifting Equipment (Ref. Fig. 408).

(1) Remove bolt and washer securing hydraulic pump drain tube clamp assembly to base of right-hand gearbox, move clamp assembly along tube, and assemble support plate. Secure plate with the two bolts.

(2) Insert lifting equipment lifting tube into engine mounted cable guide tube and secure to support plate with quick release pin.

(3) Assemble mini-hoist extension tube to mini-hoist.

(4) Pass mini-hoist cable through the lifting equipment lifting tube, and the engine mounted and FCU mounted cable guide tubes until it protrudes from base of FCU.

FCU MOUNTED CABLE GUIDE TUBE

CR 30445/00A

B

ENGINE MOUNTED CABLE GUIDE TUBE

A

SUPPORT PLATE

LIFTING TUBE

RIGHT-HAND GEARBOX

EXTENSION TUBE

MINI-HOIST

CMR 73 21 01 4 HAMO

A

ADAPTER

CABLE NIPPLE

SCREWED PLUG

B

Arrangement of Lifting Equipment
Figure 408

(5) Remove screwed plug from adapter and insert cable nipple into adapter. Replace screwed plug.

(6) Attach mini hoist to lifting tube and take up cable slack until adapter can be located in the end of the FCU mounted cable guide tube. Continue to take up cable slack until FCU/pump assembly is fully supported.

5. Remove FCU/Pump Assembly

A. Release FCU Quick Attach/Detach Coupling.

(1) Unscrew and remove bolt and spherical washer from locking trunnion.

(2) Use the approved drift against flat face of release anvil and drive coupling ring in direction to separate trunnions, until loosened.

(3) Ensure that lifting equipment supports assembly and turn coupling ring until threads disengage and align with their withdrawal slots.

B. Remove Assembly from Engine.

(1) Withdraw assembly squarely until assembly pins and drive disengages and then use lifting equipment and lower it carefully away from engine to avoid fouling tubes and fittings.

(2) Lower assembly to servicing stand to slacken cable. Remove adapter screwed plug and detach cable nipple from adapter and withdraw cable from FCU guide tube.

(3) If FCU has been removed because drive shaft has failed, carry out procedures detailed in 72-62-04, Removal/Installation.

CR 31864/00B

PINCH BOLT

BUTTERFLY SHAFT

A

DISTANCE PIECE

BUTTERFLY LEVER

WASHER

TIE BAR

ECCENTRIC BUSH

CUPWASHER

B

BUTTERFLY LEVER BOLT

CMR 73 21 01 4 JAMA

FCU/Second Stage Pump Attachment Details
(Sheet 1 of 2)
Figure 409

CR 31.868/008

AIR INLET CASING

GAP DIMENSION **Y**

BUTTERFLY PLATE
(CLOSED)

SECTION AT **A**

SPHERICAL
BEARING HOUSING

CUP WASHER

GAP DIMENSION **X**

LOCKING SLEEVE

TOP SHIMS

CONNECTING ROD

RETAINING CLIP

BOTTOM SHIMS

BALL SOCKET SET

PISTON ROD

BACKING WASHER

SECTION AT **B**

CMR 73 21 01 4 JAMB

FCU/Second Stage Pump Attachment Details
(Sheet 2 of 2)
Figure 409

6. Complete the Removal

A. General.

The procedures to follow after an assembly has been removed are determined by the reason for removal. When an assembly is to be re-installed unchanged, inhibiting would be required if the time lapse was
R to be greater than 48 hours in accordance with the
R instructions detailed in the manufacturers Component
R Overhaul Manual (73-21-04). When either an FCU or second stage pump is to be renewed, separate the units and inhibit them as detailed in the separation. sequence (Ref.para.C). For storage of FCU information
R refer to para.10.

B. Prepare to Separate the FCU and Second Stage Pump.

NOTE: If the FCU and second stage pump are to be separated the following items are removed to facilitate the pressure test procedure. The items are re-installed after completion of a satisfactory pressure test.

(1) Remove multi-connection centre assembly fuel tube section (Ref. Fig.406, Detail D).

(a) Remove bolts securing tube flanges to assembly.

(b) Remove seal plates.

(c) Remove tube.

(2) Remove elbow (Ref.Fig.406, Detail A).

(a) Remove bolts securing elbow to FCU.

(b) Remove elbow and seal plate.

(3) On engines to pre S.B. OL.593-73-8311-62 standard, remove filter and filter housing (Ref. Fig.406, Detail E).

(a) Remove bolts securing filter and housing to FCU.

(b) Remove filter housing, filter and seal plates.

(4) On engines to S.B.OL.593-73-8311-62 standard, remove filter housing.

(a) Remove bolts securing housing to FCU.

(b) Remove housing and seal plate.

C. Separate the FCU and Second Stage Pump (Ref. Fig.409).

(1) Unscrew and remove the bolt, complete with washer, from FCU tie-bar attachment point, and withdraw the eccentric bush and cupwasher from the hole in the tie-bar.

(2) Remove the nut and withdraw the lever bolt from the connecting rod spherical bearing.

(3) Remove the six bolts and washers securing the FCU to the second stage pump.

<u>NOTE:</u> When removing the shortest bolt, it will be necessary to use a flexible extension on the spanner socket in order to reach the head of the bolt.

(4) Lift to separate the pump from the two dowels in the mounting face on the FCU and remove the seal plate.

(5) Unscrew the nut and withdraw the butterfly lever and distance piece from the shaft. Slacken the tie-bar pinch bolt and withdraw the tie-bar from pump butterfly housing.

(6) If the second stage pump is to be rejected temporarily assemble the distance piece, butterfly lever and nut to the shaft. Place the mounting bolts in a polythene bag and attach to the pump.

(7) If the FCU is to be rejected, temporarily assemble the cupwasher, eccentric bush, tie-bar, washer and bolt to the FCU and retain the lever bolt in the connecting lever spherical bearing with the nut. Place the seal plate in a polythene bag and attach to the FCU.

R (8) If the units are not to be re-installed within
R 48 hours they must be inhibited in accordance with
R the instructions detailed in the manufacturers
R Component Overhaul Manual (73-21-04 FCU or 73-11-02
R SSP).

7. Prepare FCU and Second Stage Pump for Installation

A. If Units have been Separated, Carry out Pre-Installation Checks on the FCU.

(1) Ensure that inhibiting fluid is drained from unit.

(2) Check FCU drive for freedom.

(a) Rotate drive shaft through several revolutions to ensure freedom of rotating components.

(b) Install adapter - T.434850 and torque wrench to drive shaft.

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PUMP INLET CONNECTION

BOOST PRESSURE CONNECTION

DRAIN DUCT COVER PLATE

BLANKING COVER

BOOST PRESSURE CONNECTION

AIR PRESSURE CONNECTION

FCU OUTLET CONNECTION

CMR 73 21 01 4 KAMO

FCU/Pump Assembly - Pressure Test and Blanking Connections
Figure 410

(c) Check torque in both directions. Torque must not exceed 12 lbf in. for the assembly to be acceptable.

(3) Check insulation of FCU electrical connections.

(a) Connect a 500 V insulation resistance tester to the solenoid casing and from each pin in turn at all the receptacles.

(b) The resistance readings must be greater than 50 megohms to be acceptable.

B. Assemble FCU and Second Stage Pump (Ref. Fig. 409).

(1) Prepare the FCU.

(a) Remove the transportation cover and gasket from the second stage pump mounting face of the FCU and ensure that the two bobbins and the non-return valve are installed in the mounting face. Locate serviceable seal plate (Ref.70-00-03, Sealing Devices) on the dowels in the mounting face.

(b) Remove the nut, tabwasher and connecting lever bolt from the spherical bearing in the connecting rod of the air actuator piston rod and remove the bolt, washer, tie-bar, eccentric bush and cupwasher from the side face of the air actuator valve.

(2) Prepare the second stage pump as follows:

(a) Remove the nut, tabwasher, butterfly lever and distance piece from butterfly shaft.

(b) Slacken the pinch bolt in the tie-bar, assemble the tie-bar to the butterfly shaft housing and assemble the distance piece, butterfly lever, tabwasher and nut to the butterfly shaft. Restrain the butterfly lever and torque-tighten the nut to between 57 and 62 lbf in. (6,4 and 7,0 N.m) and lock using the tabwasher.

CAUTION: COMBINED FCU AND SECOND STAGE PUMP WEIGHS APPROXIMATELY 102 lb.

(3) Mount the second stage pump on the FCU dowels and secure with six bolts and washers torque-tightened

to 86 lbf in. (9,7 N.m).

NOTE: When installing the shortest bolt, it will be necessary to use a flexible extension on the spanner socket in order to reach the head of the bolt located in the recess between the air casing and the turbo pump body. The medium length bolt is shown located at the corner of the flange.

(4) Secure the tie-bar to the air actuator valve using the cupwasher, eccentric bush, washer and bolt torque-tightened to 86 lbf in. (9,7 N.m); torque-tighten the pinch bolt in the tie-bar to 37 lbf in. (4,2 N.m) and lock it with the tabwasher.

(5) Connect the air actuator valve piston rod to the butterfly valve linkage as follows:

(a) Using feeler gauges set the pump butterfly plate in the closed position but with a 0.002 to 0.005 in. clearance, shown as dimension Y, between the butterfly plate and the surrounding air inlet casing; retain in this position.

(b) Align the spherical housing in the connecting rod between the arms of the butterfly lever and check if the holes are aligned; if they are correctly aligned, insert the connecting lever bolt. If the holes are not in alignment:

(i) Disengage the connecting rod from the butterfly lever.

(ii) Hold the piston rod with holder T.446403 and remove the screwed locking sleeve complete with cupwasher, using key spanner T.446404; disengage the retaining clip and remove the ball socket set.

(iii) Adjust the connecting rod position by transferring the necessary thickness of top shims to bottom shims to raise the connecting rod. Reverse this procedure to lower the connecting rod. Install the ball socket set with the retaining clip.

(iv) Install the screwed locking sleeve and

torque-tighten to 80 lbf in. (9 N.m).

(v) Align the spherical bearing and butterfly lever and check that the connecting lever bolt can be inserted. Repeat operations (i) to (iv) as necessary until alignment is correct.

(c) Measure the gap, shown as dimension X, between the top of the piston rod and the flange of the screwed locking sleeve. Measure the thickness of the cupwasher and compare the two measurements. The gap measurement must be within 0.000 to -0.001 in. of the cupwasher thickness. If the gap measurement is not within this limit obtain it by varying the top shim thickness. When the shimming is satisfactory assemble the screwed sleeve to the piston rod, complete with cupwasher, torque-tighten sleeve to 80 lbf in. (9 N.m) and peen-over the cupwasher. The peening of the cupwasher is to be independently checked.

(d) Assemble the connecting lever bolt, tabwasher and nut, torque-tighten to 35 lbf in. (4 N.m). Do not lock with the tabwasher until the pressure test has been carried out.

(6) Pressure test and leak check (Ref. Fig. 410).

(a) Install the blanking cover (part of T.474242) on the actuator gearbox mounting face of the FCU, connection RSK.1146/12 to the main outlet, connection RSK.1143/15 to the pump inlet and blank off all remaining connections on the FCU using blanking plates T.474242. Remove the drain duct cover plate which connects with the pump mounting face of the FCU.

(b) Apply a fuel pressure of 600 psig to both the pump inlet and FCU outlet connection; ensure that no leakage occurs from the primary seal drain over a five minute period.

(c) Assemble the drain duct cover plate to the FCU and secure it with two bolts and washers torque-tightened to 32 lbf in. (3,7 N.m); connect an air supply to the connections on the blanking cover and apply an air pressure of 20 psig. Apply a fuel pressure of 600 psig

to both the pump inlet and FCU outlet connections and 40 psig to the boost connections at the blanking cover. Close the valve in the air supply line and air pressure must not reduce over a two minute period.

(7) On completion of pressure test remove the test fittings and blanking plates, lock the connecting lever bolt securing nut with the tabwasher and ensure all external locking has been carried out.

C. If Units were Separated - Install Items Removed for Pressure Test.

(1) Install fuel tube (Ref. Fig. 406) (detail D).

(a) Apply lubricant B to bolts.

(b) Hold tube in position on FCU and insert serviceable seal plates (Ref.70-00-03, Sealing Devices) at tube flange positions, then loosely retain flanges with bolts.

(c) Torque-tighten bolts securing each sealed flange in turn to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(2) Install elbow (Ref. Fig. 406) (detail A).

(a) Apply lubricant B to bolts.

(b) Position serviceable seal plate between elbow and FCU, attach elbow to FCU with four bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

R (3) On engines to pre SB OL593-73-8311-62 standard, install filter and filter housing (Ref. Fig. 406), (detail E).

(a) Apply lubricant B to bolts.

(b) Position serviceable seal plates between FCU and filter flange, and between filter flange and filter housing.

(c) Attach filter and filter housing to FCU with three bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(4) On engines to SB.OL.593-73-8311-62 standard, install filter housing.

(a) Apply lubricant B to bolts.

(b) Position a serviceable seal plate between housing and FCU.

(c) Attach housing to FCU with three bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

D. Pre-installation Checks of FCU/Pump Assembly.

(1) If not previously done, check out freedom and insulation as detailed in paragraph 7.A.

8. Install FCU/Pump Assembly

A. Prepare to Install FCU/Pump Assembly.

(1) Prepare quick attach/detach coupling.

(a) Ensure that coupling components are serviceable, correctly assembled and secure on mounting faces.

(b) Prepare coupling for tightening (Ref. 70-00-06, QAD Coupling - Installation).

(2) Position assembly as near as possible to engine in readiness for installation.

B. Install Lifting Equipment (Ref. Fig. 408).

(1) If not already in position, attach lifting equipment support plate and lifting tube as detailed in paragraphs M.(1) and (2).

(2) Pass mini-hoist cable through the lifting tube assembly and the engine mounted and FCU mounted cable guide tubes.

(3) Remove screwed plug from adapter and insert cable nipple into adapter. Replace screwed plug.

(4) Attach mini-hoist to lifting tube assembly and take up cable slack until adapter can be located in the end of the FCU mounted cable guide tube.

C. Assemble FCU/Pump Assembly to Gearbox Mounting Face.

CAUTION: GUIDE ASSEMBLY PAST TUBES AND ELECTRICAL HARNESS ATTACHED TO ENGINE AND ENSURE CLEARANCE DURING LIFTING PROCEDURE.

(1) Lift assembly to level of mounting face. Manipulate assembly to obtain clearances while lifting.

(2) Position assembly on gearbox and engage coupling ring.

(a) Place a new sealing ring in groove of gearbox mounted coupling flange face.

(b) Align assembly pins with their location.

(c) Dispose coupling ring with its thread sections facing slots on threaded flange and the spherical nut trunnion positioned to tighten to the clamping bolt trunnion when threads are engaged.

(d) Use HP hand turning equipment if it is necessary to align driving shaft splines (Ref.72-09-01, Engine Turning).

(e) Ensure that sealing ring is not displaced, press assembly squarely in position until joint faces abut.

(f) Turn coupling ring in direction to bring trunnions together, and engage threads of ring with those of threaded flange as far as possible by hand.

CAUTION: ENSURE THAT THREADS HAVE ENGAGED FREELY BEFORE APPLYING TIGHTENING FORCE TO RING.

(g) Position spherical washer on clamping bolt, then insert bolt through fixed locking trunnion to engage threads of spherical nut of coupling ring trunnion by hand.

(3) Tighten the coupling ring in accordance with the
R procedure given in 70-00-06, QAD Coupling -
R Installation. Use the following locking (run-down)
R torque and torque-tightening values for the
R clamping bolt.

(a) Locking (run-down) torque to be within the

limit 6.0 to 20 lbf in. (0,68 to 2,26 N.m).

(b) Nominal tightening torque between 170 and 190 lbf in. (19,2 and 21,5 N.m).

D. Remove Lifting Equipment.

(1) Slacken cable, remove adapter screwed plug and detach cable nipple from adapter. Remove adapter and replace its screwed plug.

(2) Wind in cable and detach mini-hoist from lifting tube.

(3) Withdraw quick removal pin then disengage lifting tube from engine mounted cable guide tube and support plate.

(4) Unscrew two bolts and detach support plate from gearbox.

(5) Apply lubricant A to bolt then secure hydraulic pump drain tube clamp assembly to gearbox with bolt and flat washer torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

9. Complete the Installation

A. Connect Air Duct to Second Stage Pump (Ref. Fig. 407).

R CAUTION: ENSURE COMPATIBILITY OF SEALING RING
R ASSEMBLY WITH DUCT (REF.S.B.OL. 593-75-4
R AND 75-8578-17).

(1) Ensure that serviceable sealing ring assembly is assembled to pump.

(2) Using the lifting tool, slide duct onto pump to engage double ended bolts with holes in pump flange.

(3) Apply lubricant B and assemble a flatwasher and nut to each of the two double ended bolts. Torque-tighten nuts to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

B. Connect Fuel Tubes.

(1) Connect tube, first stage pump to second stage pump, to second stage pump inlet elbow (Ref. Fig. 406).

(a) Position serviceable seal plate (Ref.70-00-03,

Sealing Devices) between tube flange and elbow.

(b) Apply lubricant B to attachment bolts and torque-tighten them to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

C. Install Fuel Tubes.

(1) Install fuel tube section - electric starter pump to FCU (Ref. Fig. 406).

(a) Apply lubricant A to union nut connections.

(b) Position tube section on engine and screw on union nuts hand-tight.

(c) Torque-tighten union nuts to between 280 and 310 lbf in. (32 and 35 N.m).

(d) Wire-lock union nuts.

(2) Install servo fuel tube - FCU to distribution and dump valve (Ref. Fig. 406).

(a) Apply lubricant B to attachment items.

(b) Position tube on engine, locate a serviceable seal plate and secure tube flange to its FCU location with three bolts lightly tightened.

(c) Locate a serviceable seal plate and secure tube flange to distribution and dump valve with four bolts lightly tightened.

(d) Torque-tighten bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(3) Install servo fuel tube section - FCU to distribution and dump valve rear face (Ref. Fig. 406).

(a) Apply lubricant A to clamp assembly attachment items and lubricant B to tube flange and union nut attachment items.

(b) Position tube on engine, locate serviceable seal plate and secure tube flange to its FCU location with three bolts lightly tightened.

(c) Connect union nut at tube joint and lightly tighten.

(d) Secure tube clamp assembly together with oil tank vent tube clamp assembly to support bracket with nut, bolt and two flat washers.

(e) Torque-tighten bolts at tube flange to between 67 and 73 lbf in. (7,6 and 8,2 N.m) and union nut at tube joint to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(f) Torque-tighten nut and bolt securing clamp assemblies to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

D. On No.2 and No.4 Engines Assemble Engine Flowmeter to Distribution and Dump Valve.

(1) Apply lubricant B to attachment bolts.

(2) Position flowmeter and serviceable seal plate at distribution and dump valve location.

(3) Secure flowmeter and serviceable seal plate with six bolts and flat washers. Install the two smaller diameter washers with the bolts inserted at each side of the protrusion on the flange.

(4) Torque-tighten bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

E. Install Fuel Tube - FCU to Engine Fuel Flowmeter (Ref. Fig. 406).

(1) Apply lubricant B to attachment items.

(2) Position tube on engine, locate a serviceable seal plate (Ref.70-00-03, Sealing Devices) between flanges and secure tube flange to elbow at FCU with four bolts lightly tightened.

(3) Connect fuel tube to flowmeter.

(a) Carefully insert serviceable seal plate between flanges, ensuring that the scallop of the plate is against electrical connection position.

(b) Position nut plate assembly against flowmeter flange and secure with lightly tightened nut and bolt.

(c) Assemble three bolts through fuel tube and

flow-meter flanges to engage with the three nuts of the nut plate assembly. Lightly tighten bolts.

(d) Assemble bolts at the remaining two locations and lightly tighten.

(e) Secure tube flange and electrical lead clamp to support bracket with two nuts and bolts. Locate clamp with upper nut and bolt.

(4) Torque-tighten tube flange bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(5) Connect servo fuel tube to flange at flowmeter end of tube. Use lubricant B at union nut connection and torque-tighten it to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock union nut.

F. Install Support Bracket on Second Stage Pump (Ref. Fig. 406) (detail D).

(1) Install support bracket on second stage pump.

(a) Apply lubricant A to attachment bolts.

(b) Assemble bracket to second stage pump with two bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(2) Assemble clamps, FCU to engine fuel flowmeter tube and reheat flowmeter electrical lead, to support bracket.

(a) Apply lubricant B to attachment items.

(b) Assemble tube and electrical lead clamps to the support bracket with nut, bolt and washer torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

G. Install Fuel Tube - Reheat Controller and FCU Spill to First Stage Pump Inlet Elbow (Ref. Fig. 406).

(1) Apply lubricant A to union nut connections and attachment nuts and bolts.

(2) Secure multi-connection centre assembly, tube section.

(a) Connect tube sections at centre assembly front union connection, screw on union nut hand-tight.

(b) Secure tube centre assembly to support bracket at second stage pump with two nuts and bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(c) Torque-tighten union nut to between 400 and 440 lbf in. (46 and 49 N.m) and wire-lock it.

(3) Install tube section - connection block on reheat fuel controller to multi-connection centre assembly rear union connection.

(a) Position tube on engine and screw union nuts onto their connections hand-tight.

(b) Assemble tube clamp assembly and spacer to support bracket with nut, bolt and flat washer.

(c) Torque-tighten union nuts to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(d) Torque-tighten clamp assembly retaining bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(e) Wire-lock union nuts.

H. Install First Stage Fuel Pump/FCU Gland Drain Tube (Ref. Fig. 405).

(1) Apply lubricant A to attachment items.

(2) Position tube on engine, screw union nuts to connections at FCU and second stage pump and lightly tighten.

(3) Position a new sealing washer on each side of tube connector and secure to first stage pump with fluid passage bolt torque-tightened to between 210 and 230 lbf in. (24 and 26 N.m). Wire-lock bolt.

(4) Secure clamp assembly to support bracket on main oil pump with a bolt, flatwasher and nut torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(5) Torque-tighten tube union nuts to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock union nuts.

NOTE: Should an accurate gland seal leak rate check or a pressure check using the PTIR be required, the gland drain tube connections at the first stage pump and the second stage pump are disconnected and re-connected during the test procedure.

J. Connect, Tighten and Wire-lock the Electrical Lead End Plugs at the Following Locations (Ref.Fig.403).

(1) LP governor connection on FCU.

(2) Start solenoid valve connection.

(3) Shut down solenoid valve connection.

(4) Engine fuel flowmeter connection.

(5) HP pulse probe.

K. Install Actuator Gearbox (TV).

NOTE: Ensure that the transportation gasket 77246476 is removed from the FCU prior to installing the actuator gearbox.

R CAUTION: IT IS OF THE UTMOST IMPORTANCE THAT THE
R STRAIGHTNESS CHECK ON THE FCU THROTTLE VALVE
R DRIVE SHAFT AND THE SPLINE ALIGNMENT CHECKS OF
R THE ACTUATOR GEARBOX AND FCU DRIVE SHAFTS
R (REF.73-21-01, PAGE BLOCK 600 AND 76-11-01
R PAGE BLOCK 400) ARE CARRIED OUT BEFORE
R INSTALLATION. SERIOUS OPERATIONAL PROBLEMS
R MAY OCCUR IF THESE CHECKS ARE NOT CARRIED OUT.

R (1) Carry out the straightness check on the flow
R control unit throttle valve drive shaft (Ref.
R 73-21-01, Inspection/Check).

R (2) Install the actuator gearbox (Ref.76-11-01, Removal/ Installation) and carry out the fuel pressure and leak check in conjunction with the FCU test procedure detailed in paragraph L.

L. Check for Leaks at Connections Disturbed During Procedure.

NOTE: A leak check must be made by either using static pressure or during an engine run.

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure - comply with the procedures given in 73-21-01, Adjustment/Test, paragraph 2.

(b) PTIR pressure - comply with the procedures given in 73-21-01, Adjustment/Test, paragraph 3.

(c) On completion of static pressure test and removal of installed test equipment, continue with the installation procedure of paragraph M.

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph M.

M. Complete the Installation

(1) Install fuel drain tube - second stage pump to drains tank (Ref. Fig.405).

(a) Apply lubricant B to attachment items.

(b) Position tube on engine, locate a serviceable seal plate (Ref.70-00-03, Sealing Devices) and secure tube flange to pump with four bolts lightly tightened.

(c) Screw on union nut at drains tank hand tight.

(d) Attach clamp assembly to support location with bolt, flat washer and nut.

(e) Torque-tighten bolts at tube flange to between 50 and 55 lbf in. (7,6 and 8,2 Nm).

(f) Torque-tighten union nut at drains tank to between 50 and 55 lbf ft. (68 and 74 Nm). Wire-lock union nuts.

(g) Torque-tighten clamp assembly attachment nut and bolt to between 85 and 95 lbf in (9,6 and 10,7 Nm).

(2) Attach HP pulse probe lead clamp to oil pressure pump case bracket (Ref. Fig.404).

(a) Apply lubricant B to attachment bolt.

(b) Secure HP pulse probe clamp together with seal failure drains tube clamp assembly to the support bracket with bolt and clip nut.

(c) Torque-tighten bolt to between 85 and 95 lbf in. (9,6 and 10,7 Nm).

(3) Attach electrical harness clamps to brackets on second stage pump (Ref.Fig.404).

(a) Apply lubricant B to attachment bolts.

(b) Secure three electrical harness clamps to brackets with bolts and clip nuts.

(c) Torque-tighten the bolts to between 67 and 73 lbf in. (7,6 and 8,2 Nm).

(4) Attach seal failure drains system three-way connector to bracket on second stage pump

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(Ref. Fig. 404).

(a) Apply lubricant B to attachment items.

(b) Secure the connector to the bracket with the two nuts and bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(5) On No.2 and No.4 engines, install section of HP turbine bearing oil scavenge tube - tube joint to main oil pump (Ref. Fig. 402).

(a) Apply lubricant B to flange attachment bolts and lubricant A at union connection.

(b) Position a new gasket and install tube on engine. Secure tube flange to main oil pump with five bolts lightly tightened.

(c) Screw on union nut at tube joint and torque-tighten to between 400 and 440 lbf in. (46 and 49 N.m). Wire-lock union nut.

(d) Torque-tighten bolts at tube flange to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(e) Connect, tighten and wire-lock electrical lead end plug to outlet thermometer in oil feed tube.

(6) Install LP and HP compressor thrust bearings oil scavenge tube (Ref. Fig. 402).

(a) Apply lubricant B to attachment items.

(b) Position a new gasket at each end of tube and install tube on engine.

(c) Secure tube flange to main oil pump with five bolts lightly tightened.

(d) Attach tube flange and support bracket to pulse probe drive and housing with five bolts lightly tightened. Position the two longer bolts at the bracket location.

(e) Attach electrical harness support bracket to tube with two nuts and bolts.

(f) Torque-tighten flange bolts to between 60 and 65 lbf in. (6,8 and 7,3 N.m).

(g) Torque-tighten support bracket nuts and bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(7) Install outlet section of oil tank vent tube - tube joint to overboard connection (Ref. Fig. 401).

(a) Apply lubricant A to attachment items.

(b) Locate new gasket between flanges and position tube on engine. With bracket located on tube flange secure tube joint flange with three nuts and bolts lightly tightened.

(c) Attach tube manifold elbow to support bracket with nut and bolt torque-tightened to between 135 and 145 lbf in. (15,3 and 16,4 N.m).

(d) Torque-tighten flange bolts to between 85 and 95 lbf in; (9,6 and 10,7 N.m).

(e) Connect hydraulic pump gland tube union bolt to the manifold elbow torque-tightened to between 190 and 210 lbf in. (21,5 and 23,5 N.m), wire-lock bolt.

(f) Connect IDG gland drain tube union bolt to manifold elbow and torque-tighten bolt (Ref.71-79-11, Removal/Installation).

(8) Install section of air starter vent tube - tube joint to vent tube manifold elbow (Ref. Fig. 401).

(a) Apply lubricant A to attachment items.

(b) Position tube on engine and screw on union nut at tube joint and tube union bolt at vent tube manifold elbow.

(Ref. Fig. 411).

(c) Torque-tighten union nut and union bolt to between 190 and 210 lbf in. (21,5 and 23,5 N.m). Wire-lock union nut and union bolt.

(9) Install air intake case adapter to outlet seal plate vent tube - tube joint to overboard connection (Ref. Fig. 401).

(a) Apply lubricant A to attachment items.

(b) Position tube section on engine and screw on union nut at tube joint and union bolt at vent

CR 31866/00B

A

B

SECOND STAGE PUMP MOUNTING FACE COVER

DRAIN UNION COVER

FUEL INLET COVER

L.P. GOVERNOR COVER

SUCTION RETURN COVER

AIR INLET COVER

BOOST PRESSURE COVER

AIR EXHAUST COVER

ADAPTER PLATE COVER

MANIFOLD DUMP COVER

CMR 73 21 01 4 LAMO

MAIN OUTLET COVER

STARTER FLOW COVER

EMERGENCY DUMP COVER

No 1 SOLENOID COVER

No 2 SOLENOID COVER

ACTUATOR GEARBOX MOUNTING FACE COVER

AIR/FUEL DRAIN COVER

FCU Blanks and Transportation Covers -
Location Details
Figure 411

tube manifold elbow.

(c) Attach tube clamp assembly together with air starter vent tube clamp assembly and electrical harness clamp to the LP and HP compressor thrust bearings oil scavenge tube thermocouple adapter with the bolt, flat washer and nut.

(d) Torque-tighten union nut and union bolt to between 280 and 310 lbf in. (32 and 35 N.m). Wire-lock union nut and union bolt.

(e) Torque-tighten clamp nut and bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(f) Position sealing plate at vent tube manifold elbow and secure with three nuts and bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

N. Restore Engine to Flight Standard.

(1) Replenish left-hand gearbox oil (Ref.72-01-00, Servicing).

(2) Remove safety clips, reset circuit breakers (Ref. Table 401) and open the LP fuel isolation valve.

(3) Carry out a preliminary leak check using the aircraft fuel feed pumps if a static pressure leak check procedure was not carried out.

(a) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all air from the system.

(b) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(c) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

(d) On completion of check, switch off the aircraft fuel feed pumps.

(4) Install bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the

dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(5) Carry out engine run.

(a) Reset the circuit breakers, tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing), that are required for the engine run checks.

(b) Carry out the functional check procedure and, if not statically checked, the fuel leak check procedure concurrently during an engine run as specified in 71-00-00 and 73-00-00, Adjustment/ Test respectively.

(c) On completion of engine run, retrip circuit breakers and install safety clips.

(6) Close engine bay doors (Ref.71-00-00, Servicing).

R 10. <u>Storage Procedures (Ref.Fig.411)</u>
R
R A. FCU Storage.

(1) The FCU must be properly inhibited, blanked and packaged, prior to storage.

(2) Maximum storage life of a unit is 6 years, after which the unit must be rig tested to re-certification standard.

(3) On passing the rig test and reinhibiting, the units life can be extended for a further 4 years (10 years in total).

11. Start and Shut-down Solenoid Valves (Ref.Fig.412)

A. Tools and Equipment.

Extractor	T.447107
Circuit breaker safety clip	-

B. Prepare to Remove Start and/or Shut-down Solenoid Valve(s).

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 402 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

WARNING: WHENEVER ENGINE HP CONTROL CIRCUIT BREAKER IS TO BE TRIPPED OR HP VALVE SWITCH IS TO BE SET TO OPEN, FIRST TRIP ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER AND PREVENT UNNECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMPERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
T1 PROBE HEATER SUP	13-215	1H542	C9
START FUEL PUMP SUP	1-213	1Q812	J6
HP VALVE CONT	3-213	1K131	C1
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
Engine No.2			
T1 PROBE HEATER SUP	14-215	2H542	E8
START FUEL PUMP SUP	1-213	2Q812	K6
HP VALVE CONT	1-213	2K131	C3
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19
Engine No.3			
T1 PROBE HEATER SUP	14-216	3H542	C14
START FUEL PUMP SUP	1-213	3Q812	L6
HP VALVE CONT	1-213	3K131	C3
LP VALVE SUP 1	15-216	3Q1	F1
LP VALVE SUP 2	15-215	3Q2	C20
Engine No.4			
T1 PROBE HEATER SUP	13-216	4H542	C11
START FUEL PUMP SUP	1-213	4Q812	M6
HP VALVE CONT	3-213	4K131	C2
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
Table 402

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(4) Remove heat shield assembly.

(a) Disconnect electrical lead end plugs from each solenoid receptacle.

(b) Remove two bolts, together with their washers, securing heat shield to the solenoids. Guide heat shield over the solenoid receptacles and remove heat shield.

C. Start Solenoid Valve

(1) Remove start solenoid valve.

(a) Remove four bolts, together with their washers, securing solenoid to solenoid mounting block.

(b) Attach extractor and withdraw solenoid from mounting block. Remove extractor.

(2) Install start solenoid valve.

(a) Assemble new sealing rings and back up ring to the solenoid as shown.

(b) With assembly pin in alignment with location hole in the solenoid flange, engage the solenoid in its location and press carefully into position until the mating faces of the solenoid and mounting block abut.

(c) Apply lubricant A and secure solenoid to mounting block with four bolts and washers. Torque-tighten bolts to 86 lbf in. (9,7 N.m).

(d) Complete installation procedure as detailed in in paragraph E.

D. Shut-down Solenoid Valve.

(1) Remove shut-down solenoid valve.

(a) Remove four bolts, together with their washers, securing solenoid to solenoid mounting block.

(b) Attach extractor and withdraw solenoid from mounting block. Remove extractor.

(2) Install shut-down solenoid valve.

(a) Assemble new sealing rings and back up ring to the solenoid as shown.

(b) With solenoid receptacle facing towards and horizontal to the emergency dump connection, engage the solenoid in its location and press carefully into position until the mating faces of the solenoid and mounting block abut.

(c) Apply lubricant A and secure solenoid to mounting block with four bolts and washers. Torque-tighten bolts to 86 lbf in. (9,7 N.m).

CR 33691/00A

SOLENOID MOUNTING BLOCK

START SOLENOID VALVE

HEAT SHIELD ASSEMBLY

RECEPTACLES

SEALING RINGS

SHUT-DOWN SOLENOID VALVE

BACK UP RING

CMR 73 21 01 4 MAM0

Start and Shut-down Solenoid Valves
Figure 412

(d) Complete installation procedure as detailed in paragraph E.

E. Complete Installation.

(1) Install heat shield assembly.

(a) Guide the heat shield over the solenoid receptacles and secure to solenoids with two bolts and washers with lubricant A applied. Torque-tighten bolts to 37 lbf in. (4,2 N.m).

(b) Connect, tighten and wire-lock electrical lead end plugs to their respective solenoid receptacles.

(2) Remove safety clips and reset circuit breakers listed in Table 402.

(3) Check start and shut-down solenoid valves for operation.

(a) Provide power to operate the system, and position an operator at the HP VALVE control switch and the FCU.

(b) Operate the HP VALVE control switch and verify that the solenoid valves operate. Valve operation is audible.

(c) On completion of check select HP VALVE control switch SHUT and switch off the power supply.

F. Check for Leaks at Connections Disturbed During Procedure.

NOTE: A leak check must be made by either using static pressure or during an engine run.

(1) If a static pressure test is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig as detailed in 73-21-01, Adjustment/Test in connection with the following procedures.

(a) Omit detachment of gland drain tube, installation of drain adapters and gland seal leak check for the first stage pump and the second stage pump.

(b) Remove fluid passage bolt and detach seal

drains system at actuator gearbox to provide a more precise check for leaks.

(c) If PTIR pressure is to be used, drain the fuel inlet elbow with the drain tube detailed in the removal procedure of paragraph 4.B.

(d) If aircraft fuel feed pumps are to be used.

(i) Omit procedure to bleed air from fuel system, do not disturb bleed valve dust cap.

(ii) Do not reset circuit breakers detailed in test procedure. The circuit breakers for the solenoid valve procedures have already been reset (Ref. para.E.(2)).

(e) On completion of test and removal of installed test equipment continue with the installation procedure of paragraph G (1),(2) and (4).

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph G.

G. Restore Engine to Flight Standard.

(1) If detached, connect seal failure drains system to actuator gearbox.

(a) Apply lubricant A to fluid passage bolt.

(b) Position a new sealing washer at each side of the multiple connector and secure to the actuator gearbox with fluid passage bolt torque-tightened to between 150 and 170 lbf in. (17 and 19,2 N.m).

(c) Wire-lock fluid passage bolt and tube union nuts together.

(2) If removed, install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure cap with new seal to the fuel inlet elbow drain valve. Tighten and wire-lock cap.

(3) Check for leaks during an engine run if a static pressure leak check procedure was not carried out.

(a) Reset the circuit breakers tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing) that are required for the engine run checks.

(b) Carry out the engine run and leak check procedures of 71-00-00 and 73-00-00, Adjustment/ Test respectively.

(c) On completion of engine run, retrip circuit breakers and attach safety clips.

(4) Close the engine bay doors (Ref.71-00-00, Servicing).

ENGINE FLOW CONTROL UNIT - ADJUSTMENT/TEST

1. General

This chapter is complementary to the Removal/Installation of the FCU and details the procedures for leak checks by application of a static pressure. Paragraph 2 details the leak checks using the aircraft fuel feed pumps and paragraph 3 details the leak checks using the pressure test and inhibiting rig (PTIR).

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Leak Check with Aircraft Fuel Feed Pumps

A. General

The FCU and associated connections are leak checked, using the appropriate aircraft fuel feed pump, in conjunction with the procedures detailed in 73-00-00, Adjustment/Test.

B. Tools and Equipment

Pressure test equipment items (contained in adapter set
R PE.29964) are required as follows:

Air bleed tube	PE.22898
Blank	PE.35092
Blank/bleed valve	PE.35065
Blanking unit (2)	AS.15826

C. Prepare to Leak Check FCU and Associated Connections.

(1) Electrically isolate the T1 PROBE HEATER circuit breakers (Ref.Table 501) by tripping the breaker affecting the engine upon which work is to be carried out. Attach safety clips.

WARNING: WHENEVER ENGINE HP CONTROL CIRCUIT BREAKER IS TO BE TRIPPED OR HP VALVE SWITCH IS SET TO OPEN, FIRST TRIP ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER AND PREVENT UN-NECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMP-ERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
R Engine No. 1			
R T1 PROBE HTR SUP	13-215	1H542	C 9
R Engine No. 2			
R T1 PROBE HTR SUP	14-215	2H542	E 8
R Engine No. 3			
R T1 PROBE HTR SUP	14-216	3H542	C14
R Engine No. 4			
R T1 PROBE HTR SUP	13-216	4H542	C11

R

R Circuit Breakers
R Table 501

(2) Install the following items of test equipment as detailed for each individual item in 73-00-00, Adjustment/Test, para 6.B.

(a) AS.15826 - blanking unit (Ref. Fig. 501) (detail F). Install a blanking unit on each of the fuel atomizing pilot nozzle tube junction connections.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 502). Install items in outlet connections of distribution and dump valve.

R (3) Direct free ends of drain tubes into a container.

R (4) Disconnect seal failure drains system to provide a more precise check for fuel leaks.

(a) Disconnect seal failure drains system tubes at distribution and dump valve connection.

(b) Ensure that seal failure drains system at actuator gearbox connection is detached (Ref. 76-11-01, Removal/Installation).

D. Leak Check FCU and Associated Connections.

(1) Pressurize and leak check the system up to the HP shut-off valve.

CR 31229/00B

CLAMP
BLANK
FUEL INLET ELBOW
A
B
A
DRAIN VALVE
INLET ELBOW DRAIN ADAPTER
ADAPTER SB.73-1
COVER
HOSE ASSEMBLY
SEALING RING
ADAPTER PRE SB.73-1
THROTTLE VALVE ACTUATOR GEARBOX
DRAIN ADAPTER ASSEMBLY (INCORPORATING RELIEF VALVE)
B

CMR 73 21 01 5 AAMA

Installation of Test Equipment and Location
(Sheet 1 of 2)
Figure 501

CR 31470/00C

F
E
G

BLANKING PLUG
EJECTOR PUMP OUTLET
FIRST STAGE PUMP
FIRST STAGE PUMP GLAND CONNECTION
SECOND STAGE PUMP
FIRST STAGE PUMP AND FCU GLAND DRAINS TUBE
OUTLET TUBE (SECOND STAGE PUMP FUEL / AIR DRAIN)
G
DRAIN ADAPTER
FCU GLAND DRAIN OUTLET TUBE
ADAPTER BOLT
E

CMR 73 21 01 5 AAMB

BLANKING PLUG
BLANKING PLUG
FUEL ATOMIZING PILOT NOZZLE TUBE JUNCTION
F
FIRST STAGE PUMP GLAND DRAIN ADAPTER

Installation of Test Equipment and Location
(Sheet 2 of 2)
Figure 501

(a) Remove the safety clips and reset circuit breakers (Ref.73-21-01, Removal/Installation, Table 401).

(b) Ensure that all fuel connections are secure, open the LP fuel isolation valve and start the appropriate aircraft fuel feed pumps.

(c) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) With feed pump pressure applied, check for signs of leakage at bleed valve, blanking ferrules and the drains outlets of the engine connections under test. No leaks are acceptable.

(2) Pressurize and leak check the system between the HP shut-off valve and the distribution and dump valve outlet connections.

(a) Select the HP VALVE switch OPEN and energize the start solenoid valve.

(b) Bleed air from the system by means of the bleed valve in the blank/bleed valve installed in the distribution and dump valve drain outlet.

(c) When system is free of air close valve and check system for signs of leakage. No leaks are acceptable.

(3) On completion of check, switch off pumps.

(a) Select HP VALVE switch to SHUT.

(b) Switch off the aircraft fuel feed pumps.

(4) Use the press-to-test valve facility and ascertain if gland seal leakage is excessive. If any doubt exists whether any leakage rate from the first stage pump or second stage pump/FCU gland drains are acceptable, install adapters and carry out an accurate leak rate check (Ref.73-00-00, Adjustment/Test).

(5) If a seal failure drains connection leakage should occur:

(a) Establish the location of the defective seal by reference to paragraph 3.F.

(b) Renew a defective seal or component and then repeat the leak check.

E. Remove Pressure Test Equipment and Install/Connect Engine Components.

(1) Remove the following items of test equipment and install/connect engine components as detailed for each individual item in 73-00-00, Adjustment/Test, para 6.D.

(a) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

(2) Connect seal failure drains system at distribution and dump valve.

(a) Apply lubricant A to attachment items.

(b) Connect drains system tubes to fluid passage bolt and connector and triple torque-tighten thrust wire type union nuts (Ref.70-00-04, Torque
R -tightening Technique to between 90 and 100 lbf
R in. (10,2 and 11,3 N.m).

(c) Wire-lock both union nuts.

R (3) Remove safety clip and reset circuit breaker (Ref.
R Table 501).

3. Leak Check Using PTIR

A. General.

This paragraph details the procedure for a pressure test and leak check using the PTIR and pressure test equipment. On completion of the PTIR checks a final leak check is required using the aircraft fuel feed pumps to check remade connections after removal of test equipment.

B. Tools and Equipment.

CR 31471/00B

COOLING FUEL TUBE

A

SERVO FUEL TUBE

DISTRIBUTION AND DUMP VALVE

BLANK

HOSE ASSEMBLY

BLANK/BLEED VALVE

A

SEAL DRAINS TUBES

CMR 73 21 01 5 BAMO

Distribution and Dump Valve - Installation of Test Equipment and Seal Drains Location
Figure 502

Pressure test and inhibiting rig (PTIR)... ...	PE.17988

Pressure test equipment (contained in adapter set PE.22964) are required as follows:

Air bleed tube	PE.22898
Adapter (Pre S.B.OL.593-73-1 drain valve)	PE.22972
Adapter (S.B.OL.593-73-1 drain valve) ...	PE.26710
Blank	PE.20757
Blank	PE.35092
Blank/bleed valve	PE.35065
Blanking unit (2)	AS.15826
Blanking plug	PE.29937
Clamp	PE.27277
Drain adapter	PE.20748
Drain adapter	PE.29969
Drain adapter	PE.29971
Drain adapter	PE.35666
Hose...	PE.22893
Hose...	PE.28394

C. Test Fluid.

Aviation kerosine	D.Eng.R.D.2494
or	
Inhibiting fluid	DEF.2001A or D.Eng.R.D.2490

D. Install Pressure Test Equipment.

(1) Install the following items of test equipment as detailed for each individual item in 73-00-00, Adjustment/Test para.6.B.

(a) PE.20757 - blank and PE.27277 - clamp (Ref. Fig. 501) (detail A). Install in

the fuel inlet elbow.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 adapter (S.B.OL.593-73-1 drain valve) (Ref. Fig. 501) (detail A). Assemble hose and adapter to fuel inlet elbow drain valve location.

(c) PE.29937 - blanking plug (Ref. Fig. 501) (detailE). Install in the return fuel tube at outlet to ejector pump/first stage pump.

(d) PE.35666 - drain adapter (Ref. Fig. 501) (detail B). Install adapter in the throttle valve actuator gearbox spill/drain plug location.

(e) PE.20748 - drain adapter (Ref. Fig. 501) (detail A). Assemble drain adapter to fuel inlet elbow drain connection.

(f) AS.15826 - blanking unit (Ref. Fig. 501) (detail F). Install items on fuel atomizing pilot nozzle tube junction connections.

(g) PE.28394 - hose (Ref. Fig. 502). Connect to connection on servo fuel tube near connection to distribution and dump valve.

(h) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 502). Install items in fuel outlet connections of distribution and dump valve.

(j) PE.29969 - drain adapter (Ref. Fig. 501) (detail G). Install on second stage pump (fuel/air) drain outlet.

(k) PE.29971 - drain adapter (Ref. Fig. 501) (detail E). Install in first stage pump gland drain connection.

(2) Direct free ends of drain tubes into a container.

E. Pressure Test Procedure.

(1) Disconnect seal failure drains system tubes at distribution and dump valve connection to provide a more precise check for leaks.

(2) Comply with the following general procedure for a

pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple the two self-sealing hoses of the test rig to the installed test adapter hoses at the inlet elbow and the servo fuel tube.

(c) Verify that the weight of each hose is supported and that all connections are secure before commencing test procedure.

(d) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence the test procedure.

(3) Bleed all air from the system and continue with the low pressure test, paragraph (4).

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

(b) Install air bleed tube PE.22898, open the air bleed valve and allow to bleed until an air free fuel flow is obtained and then close the valve. Allow a short settling period and repeat the bleed process to ensure that the second stage pump region is air free and again close the valve and remove air bleed tube.

(c) Open bleed valve of manifold blank/bleed valve and allow to bleed until an air free flow is again obtained and then close bleed valve.

(4) Carry out the low pressure test.

(a) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage and ensure that the following conditions are met before commencing the high pressure test.

R (a1) Gland seal leakage should be minimal. Compare with high pressure test limits as a guide (Ref.para. (5) (d) and (e)).

R (a2) No leakage from the primary static seals or connections is acceptable. If a leak shows the disconnected outlets of the seal failure drains system, find the defective seal(s) by a process of elimination (Ref.para.F).

NOTE: A leak from the fuel inlet elbow drain could be indicative of defective seals in the inlet elbow blank.

R (a3) There should be no spill from the actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

(5) Continue with a high pressure test.

(a) Operate the test rig and increase the test pressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check the disconnected seal failure drains connections. for signs of leaks. No leaks are acceptable. If a leak is disclosed, find defective seal(s) by a process of elimination (Ref.para.F).

NOTE: A seal drains connections at the FCU, distribution and dump valve and fuel inlet elbow are interconnected internally to more than one seal.

(d) Maintain the pressure long enough to measure accurately leakage from the installed drain adapters. Use a graduated measuring jar and stop watch. The acceptable limits are as follows:

R (d1) Second stage pump (fuel/air drain) ... ... 10 cc/min

R (d2) FCU ... ... 10 cc/min

R (d3) Throttle valve spill

(actuator gearbox
rear face drain) ... ... 100 cc/min

(e) If leakage from first stage pump gland drain appears excessive (10 cc/min. maximum acceptable limit carry out an accurate leak rate check as specified in 73-00-00, Adjustment/Test.

(f) Reduce test pressure to zero and stop pump motor.

(6) On completion of pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hoses. Open the bleed valves to expedite draining.

<u>CAUTION:</u> ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED. FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

F. Procedure to Locate and Rectify a Leak.

(1) Gland drains connection leakage.

(a) Excessive gland leakage is directly observed at each component and rectification will be by replacement of component.

(2) Throttle valve actuator gearbox seal failure drains connection leakage.

(a) Remove throttle valve actuator gearbox (Ref.76-11-01, Removal/Installation).

(b) Position a container to collect spill drainage from throttle valve aperture at base of FCU (100 cc/min).

(c) Apply test pressure.

(d) Check for leakage from the port (D) leading to the non-return ball valve. Collect leakage and calculate leakage rate.

Maximum acceptable - 30 cc/min.

R (e) Observe FCU drain ports, W, X and Y for signs of leakage (Ref. Fig. 503).

(e1) No leaks from these ports indicates that the cause of the leak is located in throttle valve actuator gearbox or the

actuator gearbox/FCU seal plate.

(e2) A leak from any of the three ports indicates a defective seal within the FCU or a defective FCU external joint face seal.

(f) If a leak is observed, determine the location of the defective seal by reference to TR. Figure 1 and removal of cover pates where further fault elimination is required.

(f1) Remove each drain duct cover plate, in turn, and determine from which of the ports the fuel leakage occurs. If there is
R leakage from drain port X and removal of the drain duct cover plate reveals that there is leakage from the transfer port, but not from ports F, G or H, then the defective seal plate is at the FCU fuel outlet tube.

(f2) Install the cover after each check and secure it with the two bolts and washers torque-tightened to 32 lbf in. (3,7 N.m).

(f3) Record location of defective seal(s).

(g) Release test pressure.

(h) Where possible, renew defective seals. An inaccessible seal defect requires rejection of the FCU.

Repeat the pressure test and leak when a seal has been renewed.

(3) Fuel distribution and dump valve seal failure drains connection leakage.

(a) The following seals, not all of which are affected by an FCU renewal, connect internally to the single drains outlet. A checking procedure to determine which seal is defective is given in 73-12-02, Adjustment/Test.

(a1) External fuel tube connections, manifold connections and the inlet and outlet connections of the engine fuel flowmeter.

(a2) Thermometer unit/distribution and dump

DRAIN PORT **X**

F.1. FCU FUEL OUTLET TUBE SEAL
2. BLANKING PLUG SEALS (FRONT FACE OF FCU BODY)

G.1. FCU TO DISTRIBUTION AND DUMP VALVE (SERVO TUBE) SEAL
2. STARTER PUMP TO FCU FUEL TUBE SEAL

H.1. FCU TO DISTRIBUTION AND DUMP VALVE (SERVO SPILL TUBE) SEAL

H.2. SOLENOID BLOCK SEAL

DRAIN PORT **Y**

K.1. SECOND STAGE PUMP TO FCU JOINT SEAL
2. FUEL INLET TUBE TO SECOND STAGE PUMP SEAL
3. PUMP INTERNAL SEALS

N. FCU SPILL TO FIRST STAGE PUMP INLET TUBE SEAL

DRAIN PORT **W**

1. SOLENOID BLOCK INTERFACE SEALS
2. SOLENOID VALVE SEALS
3. FCU INTERNAL SEALS

FCU Seal Failure Drains Transfer Passages and Outlets
Figure 503

R

valve joint.

(a3) Internal seals of the distribution and dump valve.

(b) Renew a defective seal or component and then repeat the pressure test and leak check.

(4) Inlet elbow seal failure drains connection leakage.

(a) Refer to 73-11-01, Adjustment/Test to identify defective seal(s).

(b) Renew a defective seal or component and then repeat the pressure test and leak check.

G. Remove Test Equipment and Install/Connect Engine Components.

(1) Remove the following items of test equipment and install engine components as detailed for each individual item in 73-00-00, Adjustment/Test, paragraph 6.D.

NOTE: If an engine is to be inhibited, refer to 70-00-07, Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(a) PE.20757 - blank and PE.27277 - clamp ring. Remove blank and clamp ring and reconnect the aircraft/engine main fuel connection.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve). Remove hose and adapter and install drain valve.

(c) PE.29937 - blanking plug. Remove plug and install blanking ferrule at ejector pump.

(d) PE.35666 - drain adapter. Remove adapter and install the blanking plug in the actuator gearbox.

(e) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

(f) PE.28394 - hose. Detach hose adapter and adapter and install blanking ferrule to connec-

tion on servo fuel tube.

(g) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

(h) PE.29969 - drain adapter. Remove drain adapter from second stage pump and connect drain tube.

(j) PE.29971 - drain adapter. Remove adapter from first stage pump and connect drain tube.

(2) Connect seal failure drains system to distribution and dump valve.

(a) Apply lubricant A to attachment items.

(b) Connect drains system tubes to fluid passage bolt and connector and triple torque-tighten thrust wire type union nuts (Ref.70-00-04, Torque Loading Data) to between 90 and 100 lbf in. (10,2 and 11,3 N.m).

(c) Wire-lock both union nuts.

(3) Carry out final leak check.

(a) Carry out a final leak check as detailed in paragraph 2.D.(1).

NOTE: The manifold flight standard blanking ferrules cannot be leak checked using aircraft feed pump pressure.

(b) On completion of check, switch off the aircraft feed pumps.

(4) PE.20748 - drain adapter. Remove drain adapter from inlet elbow and connect the seal drains system as detailed in 73-00-00, Adjustment/Test, paragraph 6.D.

(5) Complete the procedure as detailed in 73-21-01, Removal/Installation.

ENGINE FLOW CONTROL UNIT - INSPECTION/CHECK

1. General

R CAUTION: IT IS OF THE UTMOST IMPORTANCE THAT THE
R STRAIGHTNESS CHECK ON THE FCU THROTTLE VALVE
R DRIVE SHAFT AND THE SPLINE ALIGNMENT CHECKS OF
R THE ACTUATOR GEARBOX AND FCU DRIVE SHAFTS
R (REF.73-21-01, PAGE BLOCK 600 AND 76-11-01
R PAGE BLOCK 400) ARE CARRIED OUT BEFORE
R INSTALLATION. SERIOUS OPERATIONAL PROBLEMS
R MAY OCCUR IF THESE CHECKS ARE NOT CARRIED OUT.

The procedure detailed in this page block is to check the straightness of the throttle valve actuator drive shaft in the flow control unit (FCU). This check is done with throttle valve actuator gearbox (Ref.76-11-01) removed.

This procedure must be done before each installation of the throttle valve actuator gearbox. However, the procedure does not apply to new or overhauled FCUs as these have already been checked.

2. Tools and Equipment

Dial Test Indicator.

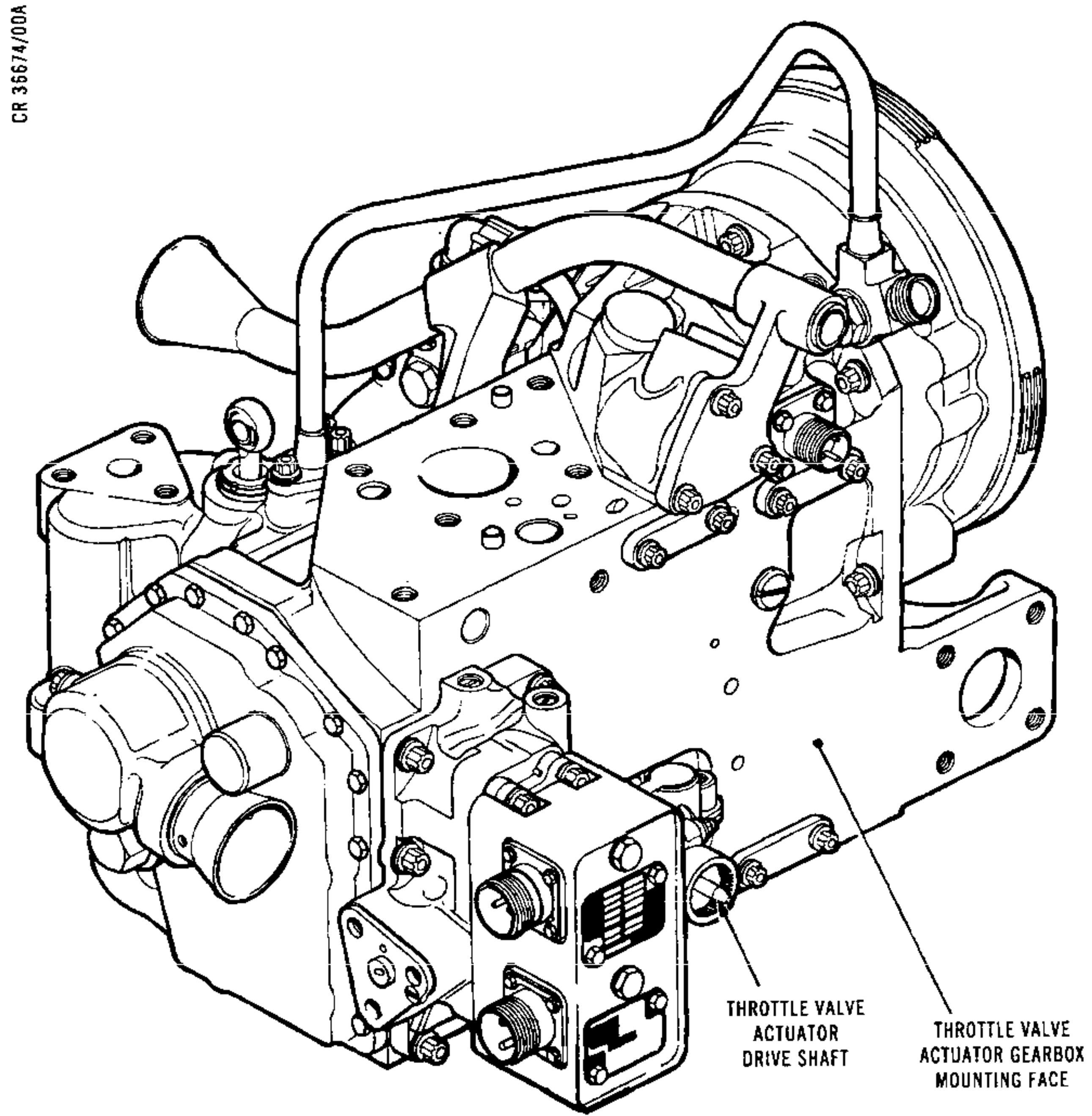
3. Flow Check Unit

A. Check Procedure (Ref. Fig.601).

(1) Using the dial test indicator (DTI), check the run-out of the throttle actuator drive shaft when it is rotated from "stop to stop". The maximum allowable run-out of the shaft is 0.003 in. (0.0762 mm).

(2) If the run-out is more than the allowable value, the fuel control unit must be rejected.

CR 36674/00A



Flow Control Unit Type FCU 115 (Rear View)
Drive Shaft Inspection/Check
Figure 601

END OF THIS SECTION

NEXT

LP COMPRESSOR OVERSPEED GOVERNING - DESCRIPTION/OPERATION

1. General

There is one complete LP compressor overspeed governing system for each engine. Each system consists of a low speed governor amplifier (LSG) and an electro pressure control (LPC) which is an integral part of the fuel flow control unit (FCU) and is described in 73-20-00. The amplifier input signal is provided by the LP compressor rpm probe. The LSG is rack-mounted in the aircraft electrical bays and described fully in this chapter.

Each governing system functions automatically in response to the LP compressor speed to reduce engine fuel flow and limit any engine overspeed condition.

A press-to-test push button on the LSG allows the system to be functionally checked during ground running.

R A yellow pop-out button on the front face of the LP compressor
R low speed governor amplifier unlatches and protrudes when the
R amplifier safety system operates.

R When the yellow pop-out button protrudes from the amplifier,
R the LP compressor overspeed governor control system is
R inoperative. The cause of the unlatching must be investigated
R prior to engine start or flight in accordance with Chart 101.

2. LP Compressor RPM Probe

One of the seven outputs of the LP compressor rpm probe is utilised to provide a signal to the LSG. The frequency of this signal is proportional to the speed of rotation of the LP shaft.

The probe is described in detail in 76-12-00, Engine RPM Probes.

3. Low Speed Governor Amplifier (Ref.Fig.001 and 002)

A. General.

The LSG is contained within a metal case which incorporates a Cannon rack/panel connector. The unit has four main sub-assemblies: an inverter section, two tile assemblies and a front panel assembly. The LSGs are mounted in the flight compartment RH or LH racking, the units for engines 1 and 2 on shelves 1-215 and 2-215, and those for engines 3 and 4 on shelves 1-216 and 2-216 respectively.

CR 31946 '00R

CANNON CONNECTOR

TOP PANEL

INVERTER AND HEAT SINK CHASSIS

MOUNTING PLATE

TILE ASSEMBLIES

SIDE PANEL

PRESS-TO-TEST PUSHBUTTON

POP-OUT INDICATOR

GROUND TEST CONNECTOR

FRONT PANEL AND HEAT SINK ASSEMBLY

BOTTOM PANEL

CMR 73 22 00 0 AAMO

Low Speed Governor Amplifier Details
Figure 001

CR 31947/00A

RH FLIGHT COMPARTMENT RACKING
ZONE 216

SHELF 2-216
26 69 22 25 39 42 8 44 19 17

SHELF 1-216
20 30 68 40 38 41 21 43 18 16

LH FLIGHT COMPARTMENT RACKING
ZONE 215

SHELF 1-215
40 17 13 42 15 24 59 36

SHELF 2-215
12 41 14 58 16 28 35 20

DATUM DEPRESS
PULSE

SUMMING
JUNCTION

CONSTANT
CURRENT
OUTPUT
STAGE

INPUT
AMPLIFIER

PULSE
SHAPER

LP COMPRESSOR
PROBE INPUT

ELECTRO
PRESSURE
CONTROL

RC
FILTER

FREQUENCY
CONVERTOR
AND
REFERENCE

DC

STABILISING
NETWORK

VOLTAGE
REGULATORS

SAFETY CIRCUITS

+12V
-12V

CMR 73 22 00 0 BAMO

28V DC
SUPPLY

INVERTER

INVERTER
INHIBIT

FAULT
OSCILLATOR

POP-OUT
INDICATOR

"HAS
OPERATED"
OSCILLATOR

Low Speed Governor Location Details
System Circuit and Diagrammatic
Figure 002

B. Description.

The inverter section consists of components mounted on printed circuit boards which are supported on a heat sink/ chassis and encapsulated in rigid polyurethane foam.

The tile assemblies consist of special thin-film circuit boards in hermetically sealed containers. The complete tile assemblies are encapsulated in rigid polyurethane foam to provide lightweight mechanical protection. The lower tile contains the signal path, the LPC drive stage and the safety circuits, while the upper tile includes the 12V internal supply regulator circuits and the pop-out indicator circuits.

The front panel assembly carries the ground test and indication facilities and also serves as a heat sink for the output transistors. The datum selection resistor is behind the modification label. Identification labels are also attached.

A radio frequency (RF) suppression circuit board assembly is located between the inverter section and the Cannon connector.

The unit container has removable top and bottom panels and fixed side panels. The main connector is at the rear and is a 26-way rectangular type with keying to align properly with the rack socket. The ground test connector on the front panel is a circular 10-way type, bayonet fitting.

C. Operation.

The power supplies for the LSG consist of a main supply to the inverter and two internal d.c. voltages. The nominal 28V supply is connected through radio frequency suppression components to a surge regulator and then to the inverter.

The input signal received by the LSG is sinusodial and of a frequency proportional to the rotational speed of the LP rotor. This signal is amplified, converted to d.c. and passed through the reference section which will result in an output to the LPC solenoid. The output will be of a magnitude to actuate the LPC when the speed signal reaches the pre-determined datum.

An isolating transformer ensures that the amplifier performance is unaffected by an earth fault in the probe signal cabling.

D. Safety Circuits.

Safety circuits sense the presence of faults that, in the absence of an engine overspeed condition, might result in governing the fuel flow. If such a fault occurs, the unit is switched to a dormant state by inhibiting the inverter.

4. System Operation (Ref.Fig.002)

A signal from the LP compressor rpm probe is transmitted to the LSG amplifier by way of a cable. The probe, wiring and LSG amplifier are arranged so that the forward, larger pulse element is used. The repetition rate of the pulses is the signal frequency.

When the signal frequency passes through the amplifier it is converted to a current which is transmitted by the amplifier output stage to the electro pressure control solenoid. The value of the current is dependent upon the signal frequency which is proportional to the amount by which the LP speed exceeds a pre-determined value. When the current reaches a pre-set datum it operates the solenoid in the LPC which, in turn, acts on the engine fuel control as described in 73-20-00. This action restricts the fuel flow to the engine combustion system and thus limits the overspeed.

If, after the system has operated, the engine speed decreases to within normal limits, the output current will decrease in response to the reduced frequency signal and the system will revert to normal.

A functional check of the system can be carried out by using the press-to-test facility. With the engine running, operation of the push button on the front panel of the amplifier unit generates a short duration pulse and gives momentary actuation of the LPC. The resulting restriction of the fuel flow is sufficient to give a noticeable reduction in indicated engine speed and demonstrates that the system is operating mechanically.

5. Static Test

An amplifier check can be carried out by the connection of a test set to the test socket on the front panel of the amplifier unit.

LP COMPRESSOR OVERSPEED GOVERNING - ADJUSTMENT/TEST

1. General

This chapter gives the procedures for testing the LP compressor overspeed governing system including the LP governor control amplifiers of type LSG 103/3/D and type LSG 103/3/E (pre and S.B.OL.593-73-8586-51 standards). Two test sets are required, one for each type of control amplifier.

The test set incorporates a self check facility and must always be checked prior to use as detailed in paragraph 3.A.

A procedure for a check of the system during an engine run, without a test set, is given in 71-00-00, ADjustment/Test.

2. Tools and Equipment

R Test set (for type LSG 103/3/D amplifier) ... TSE.103/3/D

R Test set (for type LSG 103/3/E amplifier) ... TSE.103/3/E

3. Test Procedure (Ref. Fig. 501)

A. Test Set Check.

(1) Unclip and open the test facilities cover.

(2) Remove socket covers and connect TEST socket to SELF CHECK socket with test lead supplied.

(3) Remove socket cover, and connect 28 V d.c. supply to the +28 V socket.

(4) Switch test set ON and wait for two minutes before continuing with the test procedure.

(5) Press the AUTO button. For a satisfactory check the test set will automatically run through all the tests, 1 to 27 as indicated by the binary lamps, and finish with the PASS lamp illuminated. If the test set fails to complete the test sequence, it is unacceptable for use.

(6) On completion of a satisfactory check, switch test set OFF and disconnect the 28 V d.c. supply and the test lead from the SELF CHECK socket.

(7) Assemble socket covers, close the TEST FACILITIES cover and secure it with clip.

Printed in England

CR 3332 0/00B

TEST SOCKET

DATUM DEPRESS BUTTON

POP-OUT INDICATOR

LP GOVERNOR
CONTROL AMPLIFIER

TEST LEAD

AUTO BUTTON

TEST FACILITIES COVER

TEST SOCKET

ON/OFF SWITCH

CMR 73 22 00 5 AAM0

TEST SET

MANUAL

RESET

SELF CHECK

+28V

COUNTER

Test Set and Amplifier Details
Figure 501

R

B. Carry Out System Tests.

(1) Remove socket cover and connect test lead to test socket on the front panel of the LP governor control amplifier.

(2) Ensure that the LP compressor overspeed governing system circuit breakers are set (Ref.Table 501) and the aircraft power supply is switched on.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No. 1 N1 GOVERNOR AMP SUP	1-213	1K161	C 1
Engine No. 2 N1 GOVERNOR AMP SUP	3-213	2K161	D 3
Engine No. 3 N1 GOVERNOR AMP SUP	3-213	3K161	D 4
Engine No. 4 N1 GOVERNOR AMP SUP	1-213	4K161	C 2

Circuit Breakers
Table 501

(3) Ensure that the amplifier pop-out indicator is reset (pushed in).

(4) Switch the test set ON.

NOTE: If this procedure is not carried out immediately after the test set check, wait for a period of two minutes before continuing.

(5) Press the AUTO button and the test set will commence to run automatically through the test sequence. A fault is indicated if the test does not comply with the following test sequence and can be identified by the binary lamp indication.

(a) The test set will progress from test 1 through test 11, when the amplifier pop-out indicator operates, and on to test 25 and then stop.

(b) At test 25, manually reset the amplifier pop-out

indicator, and the test set will step to test 26.

(c) At test 26, press the amplifier datum depress button and the test set will step to test 27 and the PASS lamp will illuminate to indicate a satisfactory test.

(6) On completion of a satisfactory test, complete the test procedure as detailed in paragraph 3.D. If the test set fails to complete the test sequence, carry out the fault interrogation procedure detailed in paragraph 3.C.

C. Fault Interrogation.

(1) Note the indicated position at which the test sequence stopped, compare it with those detailed below and determine the faulty component/system.

Test 1 and 2	-	Supply voltage and wiring.
Tests 3 and 4	-	Probe wiring.
Test 5	-	LPC wiring
Tests 6 to 27	-	LP governor control amplifier

(2) Assess the defect, rectify it and repeat the test procedure. Final confirmation of a defective circuit or component may be achieved by conventional continuity testing.

D. Complete the Test Procedure

(1) Switch test set OFF.

(2) Disconnect test lead from test set and amplifier sockets.

(3) Assemble protective covers to their respective sockets.

(4) Ensure that the amplifier pop-out indicator is pushed in.

LP GOVERNOR OVERSPEED AMPLIFIER - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

1. General

   The N1 governor control units are single elfin units mounted in the flight compartment racking.

2. Control Unit

   A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

   B. Prepare

      (1) Trip the associated circuit breakers and secure them with safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENG 1 N1 GOVERNOR AMP SUP	1-213	1K161	C1
ENG 2 N1 GOVERNOR AMP SUP	3-213	3K161	D3
ENG 3 N1 GOVERNOR AMP SUP	3-213	3K161	C2
ENG 4 NI GOVERNOR AMP SUP	1-213	4K161	C2

      (2) Enter the flight compartment and locate the shelf assembly.

      (3) Remove the cover from the shelf assembly and locate the control unit:

ENGINE NO	SHELF	ENGRAVING
No.1	2-215	1K162
No.2	1-215	2K162
No.3	1-216	3K162
No. 4	2-216	4K162

C. Remove

(1) Slacken the knurled screws.

(2) Withdraw the control unit, using the handle, and remove it from the shelf.

D. Prepare to Install

(1) Comply with the electrical safety precautions.

(2) Ensure that the racking is clean and pins in the connector are undamaged.

(3) Check that the connecting pins on the control unit are clean and undamaged.

E. Install

(1) Engage the control unit with the racking, slide the unit firmly into position and tighten the two securing screws.

(2) Check that the control unit is firmly bonded in accordance with 20-27-11.

F. Conclusion

(1) Refit the cover to the shelf assembly.

(2) Remove the safety clips and reset the circuit breakers previously tripped.

(3) Carry out an Operational test in accordance with (Ref. 73-22-00, Adjustment/Test).

REHEAT FUEL CONTROLLER - DESCRIPTION AND OPERATION

1. General

The reheat fuel controller is installed on the basic engine at the rear of the main fuel pump. Its rear end is fitted to a bracket on the H.P compressor case flange and its front end is bolted to the starting pump. It contains essentially hydro-mechanical and electrical components providing for the metering of the reheat fuel flow, the control of the metered fuel flow and the draining (purging) of the fuel system located downs-tream of the reheat fuel controller.

2. Description (Ref. Fig. 001)

The reheat fuel controller consists of a stainless steel casing which embodies an inlet elbow pipe to feed the fuel pressure from the 1 rst stage of the main fuel pump. The required re-heat fuel flow is obtained via a metering valve located in the casing and controlled by a motor through a mechanical reduction gear box. The motor, which is fitted to the casing is conti-nously cooled by filtered fuel providing also for bearing lu-brication (Ref. Fig. 002). To enable the metered fuel flow to the reheat system, the fuel controller casing features a shut-off valve, controlled by a shut-off solenoid valve comprising a shut-off solenoid and a four-way-shut-off distributor (Ref. Fig. 003).

To drain the spray ring residual fuel at completion of reheat operation, the reheat fuel controller embodies a purge valve assembly. This assembly features a plain piston one side of which is loaded under spring action, to maintain it closed when reheat is not in operation, and the other side of which is exposed to the fuel metered pressure allowing it to move open when reheat is selected. A transducer associated to the piston provides for checking if piston is closed thus indica-ting that purge operates normally and that reheat fuel system is shut-off (Ref. Fig. 003).

3. Operation

The reheat fuel controller provides for three main func-tions :

(a) Metering the reheat fuel flow versus parameter signals from the Reheat Control Amplifier and supplying it to the reheat fuel spray ring when reheat function is selected.

(b) Sealing completely the fuel system whenever re-heat is not in operation.

A

FUEL INLET ELBOW

P 2.5 AIR INLET

PURGE VALVE TRANSDUCER

FUEL FROM THE MAIN PUMP 1ST STAGE

SHUT-OFF SOLENOID

SHUT-OFF DISTRIBUTOR

PURGE VALVE "AIR AND FUEL" OUTLET TO THE EXHAUST ANNULUS

REDUCTION GEAR BOX

METERING VALVE MOTOR

ACCESS TO THE METERING VALVE ADJUSTING SCREW

FILTERED FUEL (SUPPLY TO THE ANCILLARY FUEL SYSTEM)

CMS 73 23 01 0 AAMO

FUEL RETURN FROM ANCILLARY FUEL SYSTEM UPSTREAM OF THE MAIN PUMP 1ST STAGE

REDUCTION GEAR BOX

METERING VALVE MOTOR

PURGE VALVE "AIR AND FUEL" OUTLET TO THE EXHAUST ANNULUS

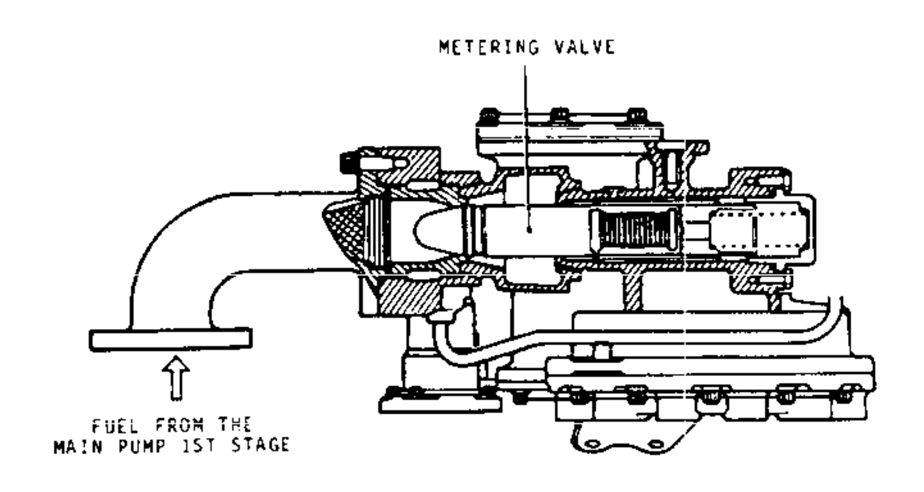
SHUT-OFF SOLENOID

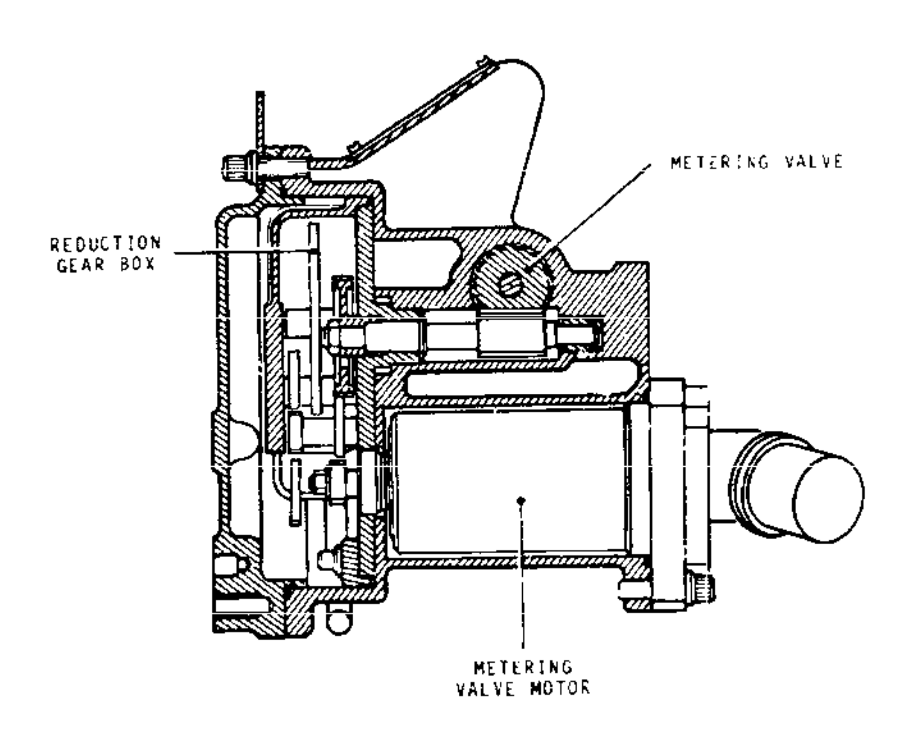
PURGE VALVE TRANSDUCER

SHUT-OFF DISTRIBUTOR

FUEL OUTLET TO THE REHEAT SPRAY RING

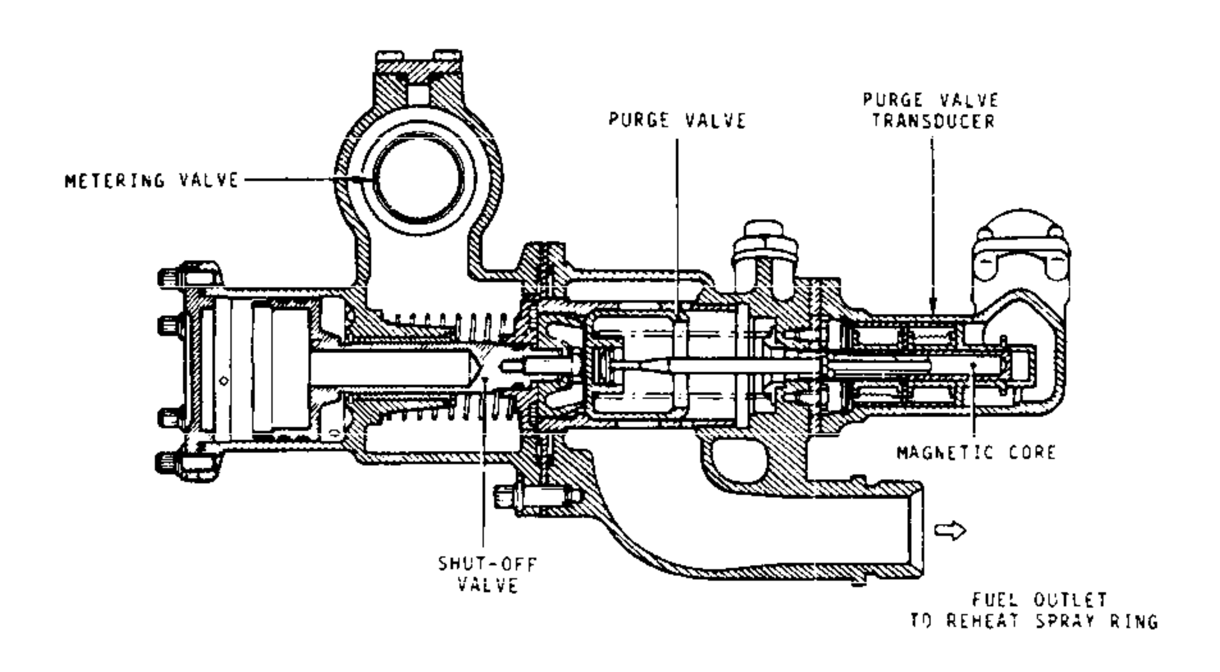
Reheat Fuel Controller
Figure 001

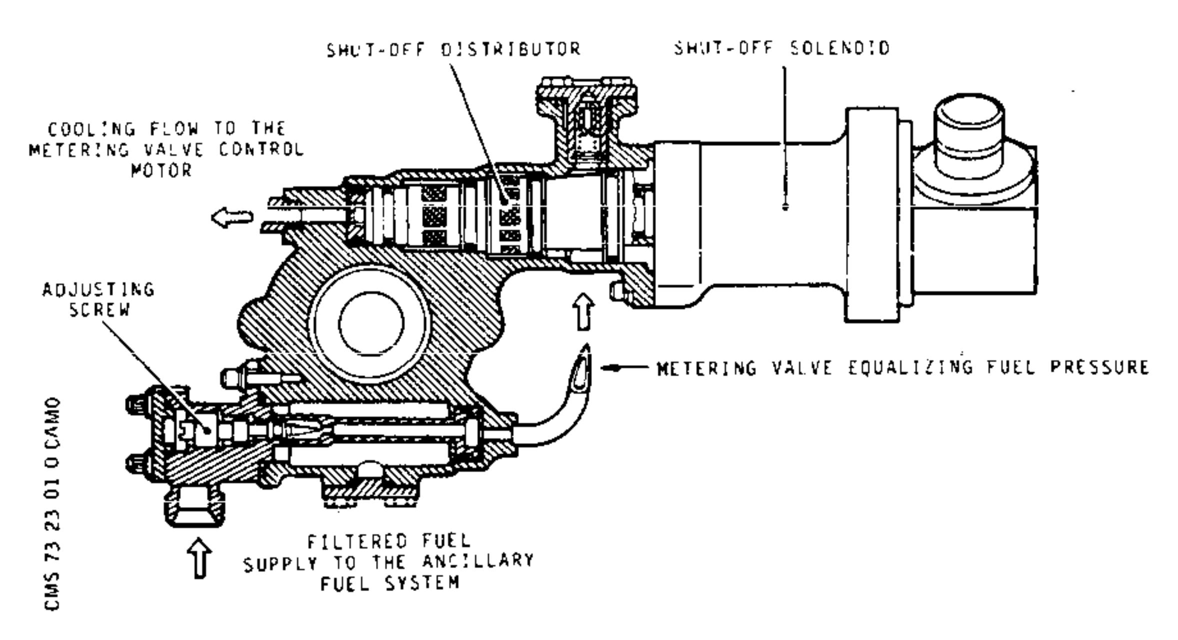




CMS 73 23 01 0 BAM0

Metering Valve
Figure 002





Shut-off Valve, Purge Valve, Shut-off Solenoid
and Shut-off Distributor
Figure 003

(c) Draining the spray ring residual fuel at completion of each reheat operation and allowing continuous air blast to sweep in the spray ring whenever reheat is not in operation.

A. Fuel Metering.

The fuel metering is obtained by a metering valve actuated, via a reduction gear box, by a two phase asynchronous motor which rotates in one direction or in the other according to the phase shift ordered by the reheat control amplifier. A tacho-generator, housed inside the motor and associated with it, supplies a feed back voltage to the reheat control amplifier for damping purposes.

When the metering valve is open, the fuel flow exerts a mechanical pressure on the metering valve. In order to reduce work-load requested from the combination "motor-reduction gear box", it is necessary to artificially create a counter-acting force in the valve body. To achieve this, a filtered fuel pressure is flowed continuously through the connection (R) (Ref. Fig. 004), the pressure level being adjusted by means of the adjusting screw.

After flowing via (G, F, D and C), this filtered fuel flow is pressurized by the diaphragm port (U) and then discharges from ports (V and W) to leave the reheat fuel controller via a return line routing it upstream of the first stage of the basic engine main fuel pump.

At reheat shut-off, the closing control of the metering valve is backed by action of the fuel counter pressure existing in the valve body which adds to the spring mechanical action. When the metering valve moves towards the "closed position", the port (U) is sealed by the inner wall of the valve bore. A resulting pressure increase occurs in the cavity (F).

B. Shut-off Valve (Ref. Fig.004 and 005)

The shut-off valve is hydraulically actuated by the shut-off distributor. The fuel from the first stage of the engine main fuel pump is supplied to the distributor, which is a four-way slide valve having two outlet ports communicating with liner of piston controlling the shut-off valve. The shut-off valve acts as a two position "CLOSED or OPEN" valve. Electrical signals supplied to the shut-off solenoid controlling the shut-off distributor are sent from the reheat control amplifier.

Besides, the fuel flowing in return system of the shut-off

METERING VALVE ELECTRIC
CONTROL MOTOR

REDUCTION
GEAR BOX

B

C

METERING
VALVE

D

V W

E

FUEL FROM THE MAIN
PUMP 1ST STAGE

U

F

G

ADJUSTING
SCREW

R

H

P 2 5 AIR

J

TRANSDUCER

SHUT-OFF
SOLENOID

FILTERED
FUEL SUPPLY

SHUT-OFF
DISTRIBUTOR

TO THE EXHAUST
ANNULUS

PURGE VALVE

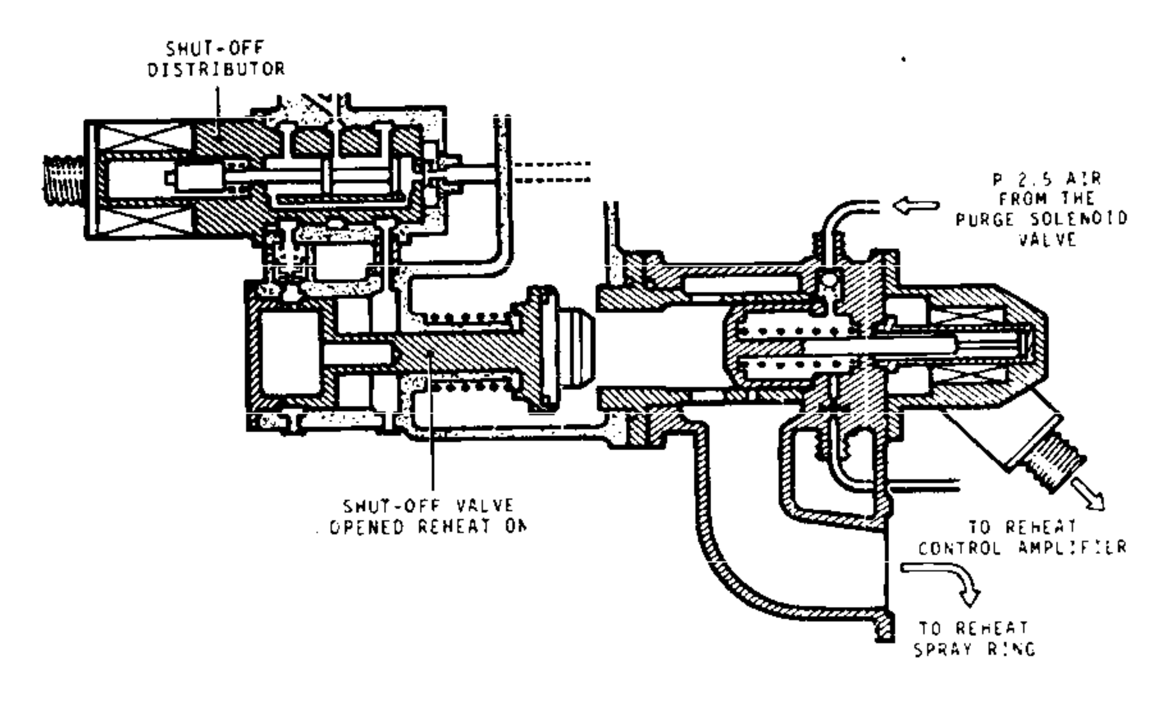
FUEL TO REHEAT
SPRAY RING

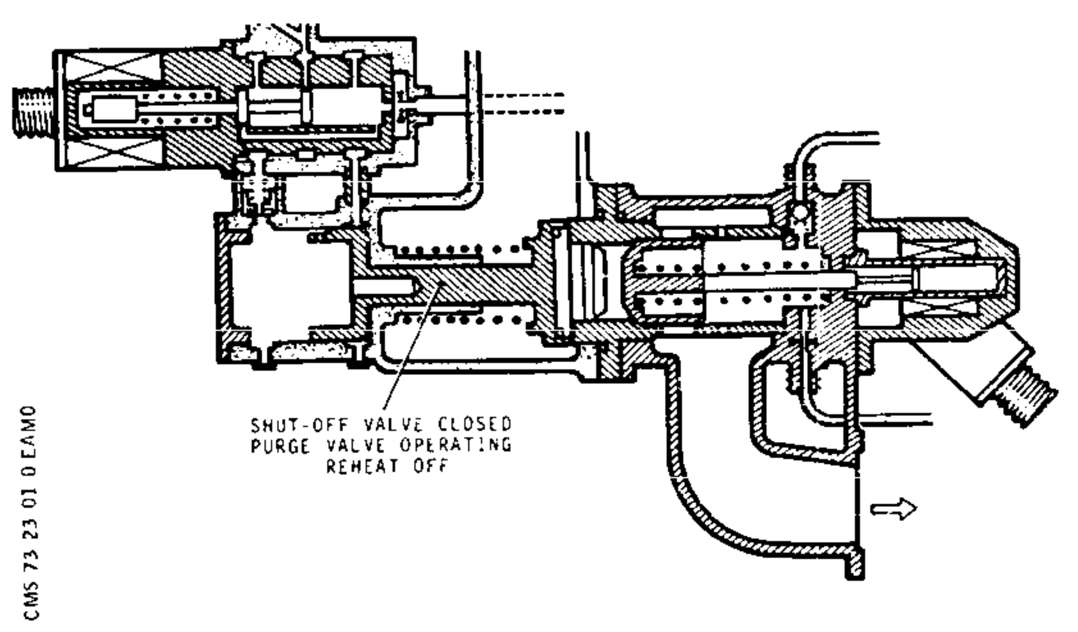
SHUT-OFF VALVE

O N M L K

CMS 73 23 01 0 DAMO

Reheat Fuel Controller Diagram
Figure 004





CMS 73 23 01 0 EAMO

Shut-off Valve and Pump Valve
Figure 005

distributor is used for cooling of the electrical motor via the fuel line (B). After circulating all around the motor, this fuel transits through the reduction gear box and discharges by the outlet connection (W).

C. Purge Valve (Ref. Fig.004 and 005)

The purpose of the purge valve is to allow, after reheat shut-off, the draining of fuel remaining in the reheat spray ring and in tubing connecting the reheat fuel controller to this spray ring.

When the reheat is in operation, the piston (M) is pushed back by the metered fuel pressure which then flows via the orifices (O). The laminar fuel leakage, which occurs during reheat operation between the piston (M) and the liner inside of which it slides, drains via the connection (K) into the exhaust stream, through a tubing connected to the basic engine exhaust annulus.

At reheat shut-off, the piston (M) which is loaded by the spring (J), rests on its seat. The purge solenoid valve which is energized during sequence T4, allows then an higher P 2.5 bleed air pressure to flow via connection (H). This air transists through the apertures (N) and flows out by the elbow (L) to provide for air sweeping of both tubing and spray ring. When the reheat is not operating, the reheat purge solenoid valve assembly maintains a steady P 2.5 bleed air flow across a diaphragm aperture.

The rod of the piston (M) actuates an induction type transducer, featuring a magnetic core translating inside a double winding. The transducer function is to detect if the purge valve piston (M) fails to close when reheat is not operating and, should this occurs, to cause the illumination of the "Reheat Fault Light" located on the Flight Engineer's monitoring panel.

REHEAT FUEL CONTROLLER - REMOVAL/INSTALLATION

1. General

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

RB NOTE: At unscheduled changes of reheat fuel controller, also change
RB the fuel filter element (Ref. 73-14-01, Servicing).

2. Tools and Equipment

DESCRIPTION	PART NO.
Air bleed tube	PE.22898
Drain tube (Pre SB OL.593-73-1 drain valve)	PE.34076
Drain tube (SB OL.593-73-1 drain valve)	PE.26796
Drain tube for heater and filter drain valve	PE.21970
Extractor, for flanged pin removal	PE.23225
Circuit breaker safety clips	-

3. Prepare to Remove Reheat Fuel Controller

A. Open engine bay doors, isolate fuel supply and electrical power.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay lower doors (Ref. 71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q 1	C 1
LP VALVE SUP 2	16-215	1Q 2	-
REHEAT AMP SUP	14-215	1K1541	C12
REHEAT CONT	15-216	1K1542	E 9
Engine No.2			
LP VALVE SUP 1	15-216	2Q 1	F 2
LP VALVE SUP 2	15-215	2Q 2	C19
REHEAT AMP SUP	13-215	2K1541	B14
REHEAT CONT	15-215	2K1542	D15
Engine No.3			
LP VALVE SUP 1	15-216	3Q 1	F 1
LP VALVE SUP 2	15-215	3Q 2	C20
REHEAT AMP SUP	13-216	3K1541	B 7
REHEAT CONT	15-215	3K1542	D16
Engine No.4			
LP VALVE SUP 1	15-216	4Q 1	C2
LP VALVE SUP 2	16-215	4Q 2	-
REHEAT AMP SUP	14-216	4K1541	D 7
REHEAT CONT	15-216	4K1542	E10

Circuit Breakers
Table 401

B. Drain the Engine Fuel System

(1) Open the bleed valve to expedite draining.

(2) Use drain tube PE.34076 (Pre SB OL.593-73-1 drain valve) or PE.26796 (SB OL.593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE.21970 at the fuel heater and filter drain valve. Direct free ends of drain tubes into a container and drain the system upstream of the FCU.

(3) Remove blanking ferrule at reheat fuel filter.

(a) Break wire-locking, loosen blanking ferrule and allow fuel to drain into a container.

(b) When draining is complete, remove blanking ferrule, apply lubricant A, reassemble ferrule and torque-tighten to between 190 and 210 lbf in (21.5 and 23.5 Nm). Wire-lock ferrule to blanking plate.

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CR 31019/00A

GASKET

B

OIL TANK VENT TUBE

LP COMPRESSOR FRONT
BEARING VENT TUBE

SEAL PLATE

A

D

C

AIR STARTER AIR
VENT TUBE

IDG GLAND
DRAIN TUBE

TUBE JOINT

HYDRAULIC PUMP GLAND DRAIN TUBE

TUBE JOINT

CMR 73 23 01 4 AAM0

VENT TUBE MANIFOLD ELBOW

SUPPORT BRACKET

D
(SEAL PLATE DETACHED)

C

Vent and Drains Tubes
Figure 401

R (4) When fuel drain ceases, remove the drain tubes and
R close the bleed valve.

NOTE: Discard drained fuel or inhibiting fluid.

C. Remove Starter Cross-feed Duct or Detach Electrical Harness Support Tray.

(1) On engines installed in No.2 or No.4 bays, remove section of cross-feed duct, intercommunication valve
R to housing (Ref.71-00-12, Removal/Installation).

(2) On engines installed in No.1 or No.3 bays, detach the electrical harness support tray and tie-rod at
R the engine mounted brackets (Ref.71-00-12, Removal/
R Installation).

D. Remove Outlet Section of Oil Tank Vent Tube (Ref. Fig. 401).

(1) Remove three nuts and detach seal plate.

(2) Remove outlet section of each of the following vent or drain tubes. Detach clamp assemblies, unscrew tube union bolts at manifold elbow of vent tube and nuts at tube union connections.

(a) Hydraulic pump oil drain tube.

(b) IDG gland drain tube.

(c) Air starter air vent tube.

(d) LP compressor front bearing air vent tube.

(3) Remove nut and bolt securing vent tube manifold elbow to support bracket.

(4) Remove three nuts and bolts at the tube joint flange. Detach bracket and remove tube and gasket from engine.

E. Remove Fuel Drain Tubes (Ref. Fig. 402).

(1) Remove second stage pump to drains tank tube.

(a) Detach two flexible and one rigid seal failure drains system tubes from connector at support bracket location.

(b) Detach tube support bracket from reheat fuel

CR 31020/00B

C

SECOND STAGE PUMP

FCU

DISTRIBUTION AND DUMP
VALVE TO DRAINS TANK TUBE

A

B

C

CMR 73 23 01 40 BAMO

SECOND STAGE PUMP TO
DRAINS TANK TUBE

DRAINS TANK

SEALING RING

A

DRAINS SYSTEM
FLEXIBLE TUBES

D

CONNECTOR

DRAINS SYSTEM
RIGID TUBE

B

REHEAT FUEL
CONTROL UNIT

SUPPORT
BRACKET

FLAT
WASHER

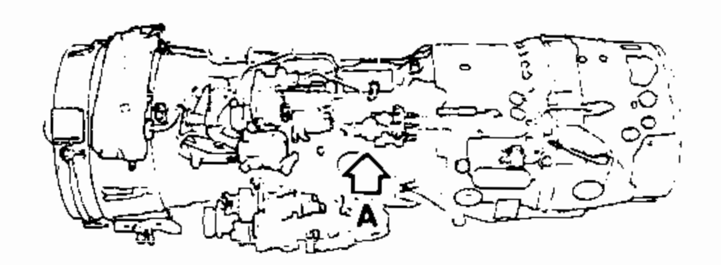
CLAMP
ASSEMBLY

D

Fuel Drain Tubes
Figure 402

R

CR 31022/00A



A

OIL TANK VENT TUBE SUPPORT BRACKET

REHEAT FUEL CONTROLLER CONNECTION BLOCK

FCU CONNECTION

FUEL RETURN TUBE

FLAT WASHER

SPACER

BRACKET

CMR 73 23 01 4 CAM0

Fuel Return Tube - Connection Block on Retreat Fuel Controller to FCU Connection
Figure 403

controller elbow flange.

(c) Unscrew tube union nuts and remove tube complete with support bracket and connector from engine.

(2) Remove seal failure drains system rigid tube - connector to overboard spill connection at drains tank.

(a) Detach tube clamp assemblies.

(b) Unscrew tube union nut at drains tank and remove tube from engine.

(3) Remove drain tube - distribution and dump valve outlet to drains tank.

(a) Detach tube support clamp and electrical cable from bracket, at diffuser case flange.

(b) Remove bolts securing tube flange to distribution and dump valve and release bracket. Do not disturb adjacent bolts.

(c) Support tube and unscrew union nut from drains tank connection.

(d) Disengage tube spigot from dump outlet and remove tube from engine.

F. Remove Fuel Return Tube - Connection Block on Reheat Fuel Controller to Tube Junction at FCU Connection (Ref. Fig. 403).

(1) Detach tube clamp assembly from oil tank vent tube support bracket.

(2) Unscrew union nut at tube junction with tube section at FCU.

(3) Support tube and unscrew union nut securing tube to connection block on reheat fuel controller. Remove tube from engine.

G. Remove Oil Tank Vent Tube Support Bracket (Ref. Fig. 404).

(1) Detach electrical leads and seal failure system drains tube support clamps from bracket.

(2) Remove nuts, flat washers and bolts securing bracket to engine. Remove bracket from engine.

CR 31023/00A

A

FCU TO FUEL FLOWMETER
FUEL TUBE FLANGE

SUPPORT CONE

ELECTRICAL HARNESS

FLAT WASHER
AND NUTS

SEAL FAILURE DRAINS
SYSTEM FLEXIBLE TUBE

OIL TANK VENT
TUBE SUPPORT
BRACKET

A

REHEAT FUEL
CONTROLLER

FLAT WASHER

CMR 73 23 01 4 DAMO

Oil Tank Vent Tube Support Bracket
Figure 404

CR 31021 00A

SHUT-OFF VALVE SOLENOID ELECTRICAL CONNECTION

CONNECTION BLOCK

A

B

REHEAT FUEL CONTROLLER

REHEAT METERING VALVE MOTOR ELECTRICAL CONNECTION

PURGE VALVE TRANSDUCER ELECTRICAL CONNECTION

CONNECTION BLOCK

ELECTRICAL LEADS

FLAT WASHER

SEAL FAILURE DRAINS SYSTEM TUBE

PILLAR BOLT

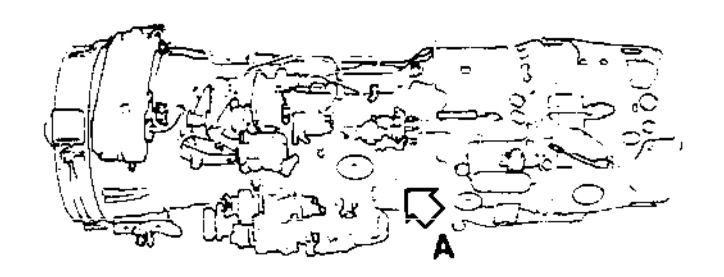
A

B

CMR 73 23 01 4 EAMO

Electrical Lead Connections and Clipping at Reheat Fuel Controller
Figure 405

CR 31024/00A



REHEAT FUEL OUTLET TUBE

REHEAT FUEL CONTROLLER

A

PURGE AIR AND FUEL SPILL OUTLET TUBE

CMR 73 23 01 4 FAMD

PURGE AIR INLET TUBE

REHEAT FUEL FLOWMETER

SEAL PLATE

SERVO SUPPLY TUBE

Reheat Fuel Controller Flowmeter
and Tube Connections
Figure 406

R 4. Remove Reheat Fuel Controller

A. Disconnect Electrical Leads from Reheat Fuel Controller (Ref. Fig. 405).

R (1) Disconnect electrical lead end plugs from the following locations and detach support clamps from base of reheat fuel controller.

(a) Reheat metering valve motor.

(b) Shut-off valve solenoid.

(c) Purge valve transducer.

B. Detach Tubes and Flowmeter from Reheat Fuel Controller (Ref. Fig. 406).

(1) Unscrew union nuts to detach the following tubes from the unit.

(a) Purge air inlet tube.

(b) Purge air and fuel spill outlet tube.

(c) Reheat fuel outlet tube.

(d) Servo supply tube.

(2) Detach reheat fuel flowmeter from controller.

(a) Remove nuts, bolts and flat washers securing flowmeter to controller.

(b) Withdraw seal plate.

C. Detach Controller from Mountings (Ref. Fig. 407).

(1) Remove two nuts, flat washers and bolts and detach bracket at front steady position of controller from similar bracket mounted on the distribution and dump valve.

(2) Remove the two bolts that secure the bracket to the distribution and dump valve and remove bracket from engine.

(3) Remove nut, bolt and flat washer at controller support cone mounting location and remove distance piece.

CR 31025/00A

SUPPORT CONE
A
DISTANCE PIECE
FLAT WASHER

B
MOUNTING PLATE
FLANGED PINS
REHEAT FUEL CONTROLLER

A
C
D
E
B

CMR 73 23 01 4 GAMO

REHEAT FUEL CONTROLLER
C
DISTRIBUTION AND DUMP VALVE

DISTRIBUTION AND DUMP VALVE
D
FLANGED PIN
E
FLANGED PIN

Reheat Fuel Controller Attachment
Figure 407

(4) Remove four bolts securing rear end of controller to mounting plate and distribution and dump valve. Support unit and extract flanged pins.

(5) Manoeuvre controller from engine.

D. Complete the Removal.

(1) If a new controller is to be installed, remove the following items for transfer to a new unit.

(a) Remove fuel return tube and connection block.

(i) Detach tube clamp assembly from bracket on controller.

(ii) Unscrew tube union nuts at connection block and controller and remove tube.

(iii) Remove nuts and bolts securing connection block to controller and remove connection block.

(b) Remove bolts and flat washers securing support cone to controller. Remove cone complete with two headless pins.

R 5. Install Reheat Fuel Controller

R A. Prepare a New Fuel Controller for Installation.

(1) Drain inhibiting fluid from controller.

R (2) Install fuel return tube and connection block.

R (a) Apply lubricant B to clamp assembly items and
R securing bolts and nuts. Apply lubricant A to
R union connections.

R (b) Secure connection block to controller with two
R nuts and bolts torque-tightened to between 85
R and 95 lbf in. (9,6 and 10,7 N.m).

R NOTE: Install pillar bolt at lower location
R for subsequent attachment of electrical
R lead clamp.

R (c) Position tube on controller and connect union
R nuts at connection block and controller.

R (d) Attach tube clamp assembly to bracket on

R controller with clip nut, flat washer and bolt
R torque-tightened to between 85 and 95 lbf in.
R 9,6 and 10,7 N.m).

R (e) Torque-tighten union nut at connection block
R to between 190 and 210 lbf in. (21,5 and 23,5
R N.m). and union nut at controller to between
R 220 and 240 lbf in. (25 and 27 N.m).

R (f) Wire-lock tube union nuts.

R (3) Install support cone.

R (a) Ensure that the two headless pins are still in
R place in support cone.

R (b) Apply lubricant B and assemble a flat washer
R to each of the four bolts.

R (c) Assemble support cone to controller and secure
R it with four bolts torque-tightened to between
R 67 and 73 lbf in. (7,6 and 8,2 N.m).

R B. Attach and Secure Controller to Mountings (Ref. Fig. 407).

(1) Apply lubricant A to two bolts securing support bracket at distribution and dump valve and to support cone bolt. Apply lubricant B to remaining attachment items.

(2) Support controller in position on engine, insert four flanged pins at rear mounting location and secure with four bolts lightly tightened.

(3) Locate the distance piece between the controller support cone and its support bracket at the front mounting location, insert bolt and washer then assemble and lightly tighten nut.

(4) Position bracket between controller and distribution and dump valve and secure it to the distribution and dump valve with two bolts torque-tightened to 86 lbf in. (9,7 N.m).

(5) Assemble two bolts, flat washers and nuts to attach bracket at front steady position of controller to the bracket on the distribution and dump valve.

R (6) Torque-tighten bolts.

(a) Rear mountings (at flanged pins) to between 160

and 180 lbf in. (18,1 and 20,3 N.m).

(b) Front mounting (at spacer) to between 170 and 190 lbf in. (19,2 and 21,5 N.m).

(c) Front mounting (at bracket) to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

C. Attach reheat Fuel Flowmeter to Controller (Ref. Fig. 406).

(1) Apply lubricant B to attachment items.

(2) Carefully insert serviceable seal plate (Ref. 70-00-03, Sealing Devices) between flowmeter flange and controller elbow.

(3) Install bolts with a small diameter flat washer at each side of the protrusion on the flange, secure with nuts and lightly tighten.

(4) Install the remaining four bolts, nuts and flat washers.

(5) Torque-tighten bolts to between 67 and 73 lbf in. (7,6 and 8,2 Nm).

D. Connect Tubes to Controller (Ref. Fig. 406).

R CAUTION: ON SB OL593-73-14081-98 STANDARD ENGINES,
R ENSURE THE FILTER IN THE INLET UNION TO
R THE ANCILLARY FUEL SYSTEM OF THE REHEAT
R FUEL CONTROLLER IS CLEAN.

(1) Connect reheat fuel outlet tube.

(a) Apply lubricant A to union connection items and engage union nut. Screw up union nut by hand until the visible part of the thread is less than 2,5 mm (0.10 in).

(b) Torque-tighten union nut to between 600 and 660 lbf in. (68 and 74 N.m) and wire-lock it.

(c) Remove any existing marks if not in alignment after tightening nut. Paint a line, visible from underside of an installed engine, in heat resisting paint to extend across the tube union nut and controller connection.

(2) Connect purge air inlet tube.

(a) Apply lubricant A to union connection items and engage union nut hand-tight.

(b) Torque-tighten union nut to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

NOTE: The union nut is wire-locked together with the purge air and fuel spill outlet tube on completion of pressure testing.

(3) Connect servo supply tube.

(a) Apply lubricant A to union connection items and engage union nut hand-tight.

(b) Torque-tighten union nut to between 190 and 210 lbf in. (21,5 and 23,5 N.m) and wire-lock it.

E. Connect and Secure Electrical Leads (Ref. Fig.405).

NOTE: Prior to connecting leads clean all connectors with "Amberklene" electrical cleaning fluid. This is necessary due to the sensitivity of the reheat fuel controller to connector contamination.

(1) Connect, tighten and wire-lock lead end plugs at the following locations.

(a) Reheat throttle valve motor.

(b) Shut-off valve solenoid.

(c) Purge valve position indicator.

(2) Secure four electrical lead support clamps to controller as shown.

(a) Apply lubricant A to attachment items and assemble front clamp to pillar bolt securing connection block. Torque-tighten nut to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(b) Apply lubricant B to attachment items and assemble centre clamp together with seal failure drains tube clamp to support bracket with clip nut and bolt. Torque-tighten bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(c) Apply lubricant B to attachment items and secure two rear clamps to support bracket with bolts screwed into clip nuts. Torque-tighten each bolt to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

6. Complete the Installation

A. Install Oil Tank Vent Tube Support Bracket (Ref. Fig.404).

(1) Position support bracket on engine.

(2) Secure bracket at location on FCU to flowmeter fuel tube flange with two nuts and bolts, lubricant B applied. Ensure that electrical lead clamp is secured by the longer bolt at the position shown. Lightly tighten both nuts.

(3) Secure bracket to support cone pillar bolts with two nuts and washers, lubricant B applied. Lightly tighten both nuts.

(4) Apply lubricant A to attachment items and secure rear of bracket to attachment with two nuts and bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(5) Torque-tighten four remaining nuts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(6) Attach electrical lead clamp to support bracket with nut and bolt, lubricant B applied, and torque-tighten to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(7) Attach electrical lead clamp and seal failure drains system tube clamp assembly to bracket with nuts, flat washer and bolts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m) with lubricant B applied.

B. Install Fuel Return Tube - Connection Block on Controller to FCU Connection (Ref. Fig.403).

(1) Apply lubricant A to union connections, lubricant B to clamp assembly items.

(2) Position tube on engine and screw union nuts onto their connections hand-tight.

(3) Attach tube clamp assembly to oil tank vent tube support bracket with bolt, flat washer, spacer and nut.

(4) Torque-tighten union nut at block connection on fuel controller to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(5) Torque-tighten union nut at connection with tube section to FCU to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(6) Wire-lock union nuts.

(7) Torque-tighten clamp assembly retaining bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

C. Install Fuel Drain Tubes (Ref.Fig.402).

(1) Install fuel drain tube - second stage pump to drains tank.

(a) Apply lubricant A to union nut connections at pump and tank and to flexible tube union nut connections at connector.

(b) Position tube on engine and connect tube union nuts at second stage pump and drains tank hand-tight.

(c) Apply lubricant B to attachment bolts and secure tube support bracket to controller elbow flange with two bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m). If difficulty is experienced in attaching the bracket, refer to S.B.OL.593-75-8137-20.

(d) Torque-tighten drain tube union nuts to between 600 and 660 lbf in. (68 and 74 N.m) and wire-lock them.

(2) Install seal failure drains system rigid tube - connector to overboard connection at drains tank.

(a) Apply lubricant A to union nut connections and lubricant B to clamp assemblies attachment items.

(b) Position tube on engine and screw on tube union nuts at connector and drains tank.

(c) Attach tube clamp assemblies with nut, flat washer and bolt.

(d) Torque-tighten union nuts to between 190 and 210 lbf in. (21,5 and 23,5 N.m) and clamp bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(e) Wire-lock union nuts.

(3) Connect flexible seal failure drains system tubes to connector.

(a) Apply lubricant A to union nut connections.

(b) Attach the two drain tube union nuts to connector and triple torque-tighten thrust wire type union nuts (Ref.70-00-04, Torque Loading Data) to between 90 and 100 lbf in. (10,2 and 11,3 N.m).

(c) Wire-lock union nuts.

(4) Install drain tube - distribution and dump valve to drains tank.

(a) Apply lubricant A to attachment items.

(b) Assemble a new sealing ring to the spigot groove of attachment flange.

(c) Engage tube spigot squarely with dump outlet of distribution and dump valve and union nut with drains tank union and hold in position.

(d) Screw union nut on hand-tight and retain flange and bracket to distribution and dump valve with the three bolts lightly tightened. Locate two longer bolts to retain bracket.

(e) Secure tube and electrical cable to bracket at diffuser case flange with clamp assembly, bolt, washer, and nut. Torque-tighten nut to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(f) Torque-tighten tube flange retaining bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m) and union nut to between 310 and 340 lbf in. (35 and 38 N.m).

(g) Wire-lock union nut.

D. Check for Leaks at Connections Disturbed During Procedure.

(1) If a static pressure test for fuel leaks is to be carried out, use the pressure test and inhibiting rig (PTIR) procedures given in 73-23-01, Adjustment/Test.

(2) On completion of a static pressure test and removal of installed test equipment continue with the installation procedure of paragraph E.

(3) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph E.

E. Complete the Installation.

(1) Connect purge air and fuel spill outlet tube to controller (Ref.Fig.406).

(a) Apply lubricant A to union connection.

(b) Screw on union nut and torque-tighten to between 140 and 160 lbf in. (15,8 and 18,1 N.m). Wire-lock union nuts at purge valve.

(2) Install outlet section of oil tank vent tube (Ref. Fig.401).

(a) Apply lubricant A to attachment bolts.

(b) Position a new gasket between flanges and locate tube section on engine. With bracket located on tube flange secure tube flanged joint with three nuts and bolts lightly tightened.

(c) Attach vent tube manifold elbow to support bracket with nut and bolt lightly tightened.

(d) Torque-tighten flange bolts to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(e) Torque-tighten bolt at support bracket to between 135 and 145 lbf in. (15,2 and 16,3 N.m).

(3) Install section of air starter air vent tube - tube joint to vent tube manifold elbow (Ref.Fig.401).

(a) Apply lubricant A to attachment items.

(b) Position tube on engine and screw on union nut at tube joint and tube union bolt at vent tube manifold elbow.

(c) Torque-tighten union nut and union bolt to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(d) Wire-lock union nut at tube joint.

(4) Install section of LP compressor front bearing vent tube - tube joint to vent tube manifold elbow (Ref.Fig.401).

(a) Apply lubricant A to attachment items.

(b) Position tube on engine and screw on union nut at tube joint and union bolt at vent tube manifold elbow.

(c) Attach tube clamp assembly, together with air starter vent tube clamp assembly, and electrical harness clamp to the LP and HP compressors thrust bearings oil scavenge tube with nut, flat washer and bolt.

(d) Torque-tighten union nut and union bolt to between 280 and 310 lbf in. (32 and 35 N.m).

(e) Torque-tighten clamp assemblies securing bolt to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(f) Wire-lock union nut at tube joint.

(5) Install section of hydraulic pump oil drain tube - tube joint to vent tube manifold elbow (Ref.Fig.401).

(a) Apply lubricant A to union nut and union bolt. Apply lubricant B to clamp assembly items.

(b) Position tube on engine and screw on union nut at tube joint and union bolt at manifold elbow.

(c) Secure each clamp assembly with nut, bolt and flat washer in conjunction with the IDG gland drain tube installation procedure given in paragraph (6). Torque-tighten each nut to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(d) Torque-tighten both tube union nut and bolt to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(e) Wirelock union nut at tube joint.

(6) Install section of IDG gland drain tube - tube joint to vent tube manifold elbow (Ref.71-00-02, Power Plant Build-Up Manual).

(7) Wire-lock the four tube union bolts at vent tube manifold elbow.

(8) Install seal plate at vent tube manifold elbow (Ref. Fig. 401).

(a) Apply lubricant A to attachment items.

(b) Position seal plate at vent tube manifold elbow and secure with three nuts and bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

(9) On engines installed in No.2 or No.4 bays, install section of cross-feed duct intercommunication valve to housing (Ref.71-00-12, Removal/Installation).

(10) On engines installed in No.1 or No.3 bays, secure electrical harness support tray and tie-rod to the engine mounted brackets (Ref.71-00-12, Removal/Installation).

F. Restore Engine to Flight Standard

(1) If a leak check is to be made during an engine run carry out a preliminary leak check using the aircraft fuel feed pumps.

(a) Remove safety clips, reset circuit breakers (Ref. Table 401) and open the LP fuel isolation valve.

(b) Install air bleed tube PE.22898, start appropriate aircraft fuel feed pumps and bleed all air from the system.

(c) When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

(e) On completion of check, switch off the aircraft fuel feed pumps.

(2) To complete the installation or prepare for ground run, install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(3) Remove safety clips, reset circuit breakers (Ref. Table 401), and open the LP fuel isolation valve.

(4) Carry out engine run.

(a) Reset the circuit breakers, tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing), that are required for the engine run checks.

(b) Carry out the functional check procedure and, if not statically checked, the fuel leak check procedure concurrently during an engine run as specified in 71-00-00 and 73-00-00, Adjustment/Test respectively.

(c) On completion of engine run, retrip circuit breakers and install safety clips.

(5) Close engine bay doors (Ref.71-00-00, Servicing).

REHEAT FUEL CONTROLLER - ADJUSTMENT/TEST

1. Pressure Test and Leak Check the Reheat Fuel Controller

A. General

This procedure is complementary to the Removal/Installation of the reheat fuel controller and details the procedure for a leak check by application of a static pressure using the PTIR. If required, a partial leak check of the reheat controller up to the shut-off valve can be carried out using the appropriate aircraft fuel feed pumps as detailed in 73-00-00, Adjustment/Test.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

B. Tools and Equipment

Pressure test and inhibiting rig (PTIR) ... PE.17988

R Pressure test equipment (contained in adapter set PE.29964) is required as follows:

Air bleed tube	PE.22898
Adapter (Engine No.1 or 3)	9970-531 -043
Adapter (Engine No.2 or 4)	9970-521 -075
Blank, for purge valve air/fuel spill outlet tube connection	-
Adapter (Pre S.B.OL.593-73-1 drain valve)	PE.22972
Adapter (S.B.OL.593-73-1 drain valve) ...	PE.26710
Blank	PE.20757
Blanking unit (2)	AS.15826
Blanking plug	PE.29937
Clamp	PE.27277
Drain adapter	PE.20748
Drain adapter	PE.35666

Hose... ... ... PE.22893

C. Test Fluid

Aviation kerosine D.Eng.R.D.2494
or
Inhibiting fluid ... ... DEF.2001A or D.Eng.R.D.2490

D. Prepare for Pressure Test

(1) Plug spray ring tube elbow with a wax plug as detailed in 73-12-06, Removal/Installation.

R NOTE: The wax plug is formed to blank off the spray
R ring to enable a static pressure to be applied
R and will be dispersed when the engine is run.

(2) Remove fluid passage bolt from seal failure drains system at reheat flowmeter connection to provide a more precise check for leaks (Ref. Fig. 501) (detail H).

E. Install Pressure Test Equipment

R (1) Carry out the procedures of 73-00-00,Adjustment/Test,
R paragraph 6.B., as detailed for the installation and removal of the following items of test equipment and engine components respectively.

(a) PE.20757 - blank and PE.27277 - clamp (Ref. Fig. 501) (detail A). Install in fuel inlet elbow.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 adapter (S.B.OL.593-73-1 drain valve) (Ref. Fig. 501) (detail A). Assemble hose and adapter to fuel inlet elbow drain valve location.

(c) PE.29937 - blanking plug (Ref. Fig. 501) (detail E). Install in the return fuel tube at outlet to ejector pump/first stage pump.

(d) PE.35666 - drain adapter (Ref. Fig. 501) (detail B). Install adapter in the throttle valve actuator gearbox casing spill/drain valve location.

(e) PE.20748 - drain adapter (Ref. Fig. 501)

CR 31229/00 B

CLAMP
BLANK
FUEL INLET ELBOW
A
B
INLET ELBOW DRAIN ADAPTER
DRAIN VALVE
ADAPTER SB.73-1
COVER
HOSE ASSEMBLY
SEALING RING
ADAPTER PRE SB.73-1
THROTTLE VALVE ACTUATOR GEARBOX
DRAIN ADAPTER ASSEMBLY (INCORPORATING RELIEF VALVE)

CMR 73 23 01 5 AAMA

Installation of Test Equipment and Location
(Sheet 1 of 2)
Figure 501

R

CR 31458/00C

E

F

H

BLANKING PLUG

EJECTOR PUMP OUTLET

FIRST STAGE PUMP

E

SEAL DRAINS TUBE

REHEAT FLOWMETER
SEAL DRAINS
OUTLET

FUEL ATOMIZING PILOT
NOZZLE TUBE JUNCTION

BLANKING PLUGS

F

CMR 73 23 01 5 AAMB

H

SEAL DRAINS TUBE

Installation of Test Equipment and Location
(Sheet 2 of 2)
Figure 501

R

(detail A). Assemble drain adapter to fuel inlet elbow drain connection.

(f) AS.15826 - blanking unit (Ref. Fig. 501) (detail F). Install items on fuel atomizing pilot nozzle tube junction connections.

(g) 9970-531-043 - adapter (Ref. Fig. 502)
R (detail C). On engines No.1 or 3 detach purge
R air tube from reheat purge solenoid valve and
R assemble adapter in tube end.

R (h) 9970-521-075 - adapter (Ref. Fig. 502) (detail-
R D). On engines No.2 or 4 detach purge air tube
R from reheat purge valve and assemble adapter to
R valve.

R (j) - blank (Ref. Fig. 502) (detail B).
R Assemble blank in purge air/fuel tube.

(2) Direct free ends of drain tubes into a container.

F. Pressure Test Procedure.

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple a self-sealing hose of the test rig to the installed test adapter hose at the inlet elbow.

(c) Connect a test rig delivery hose to the test adapter at the reheat fuel supply tube and tighten the union nut.

(d) Verify that the weight of each hose is supported and that all connections are secure before commencing test procedure.

(e) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence

CR 31232/00C

A

C

FORWARD

D

B

WAX PLUG

PURGE AIR/FUEL TUBE-
PURGE VALVE TO SPHERICAL
JOINT FLANGE

FROM PURGE
VALVE

BLANK

A

B

REHEAT FUEL
SPRAY RING

REHEAT PURGE
SOLENOID VALVE

PURGE AIR TUBE-
SOLENOID VALVE
TO PURGE VALVE

PURGE AIR TUBE-
SOLENOID VALVE
TO PURGE VALVE

REHEAT FUEL
CONTROLLER

ADAPTER

CMR 73 23 01 5 BAMD

REHEAT
PURGE VALVE

C

D

ADAPTER

INPUT ADAPTER
No. 1 OR 3 ENGINES

INPUT ADAPTER
No. 2 OR 4 ENGINES

Installation of Reheat Test Equipment and
Location
Figure 502

the test procedure.

(2) Bleed all air from the system and continue with the low pressure test, paragraph (3).

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

(b) Install air bleed tube PE.22898, open the air bleed valve and allow to bleed until an air free fuel flow is obtained and then close the valve. Remove air bleed tube.

(3) Carry out the low pressure test.

(a) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage and ensure that the following conditions are met before commencing the medium pressure test.

R (a1) No leakage from the primary static seals is acceptable. If a leak shows from the disconnected outlets of the seal failure drains system, rectify defect (Ref. para.G.).

NOTE: A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

R (a2) There should be no spill from the actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

(4) Carry out a medium pressure test of the reheat system.

CAUTION: ENSURE THAT MEDIUM TEST PRESSURE IS NOT EXCEEDED WHEN TEST RIG IS CONNECTED TO REHEAT SYSTEM.

(a) Operate the test rig and increase the test pressure to 170 psig (1172 kPa).

(b) Apply pressure for at least three minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Reduce test pressure to zero.

(d) On completion of reheat system test, disconnect test rig supply hose from adapter and test rig manifold coupling. Ensure that test rig coupling seals off rig delivery.

(5) When test rig is disconnected from the reheat system, continue with a high pressure test.

(a) Operate the test rig and increase the test ppressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check the disconnected seal failure drains connections for signs of leaks. No leaks are acceptable. If a leak is disclosed, rectify defect (Ref.para.G).

NOTE: The seal drains connections at the reheat fuel controller and inlet elbow are interconnected internally to more than one seal.

(d) If spill from actuator gearbox adapters appears excessive (100 cc.min. maximum acceptable limit) carry out an accurate leak rate check as specified in 73-00-00 Adjustment/Test.

(e) Reduce test pressure to zero and stop pump motor.

(6) On completion of pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hose. Open the bleed valve to expedite draining.

CAUTION: ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED. FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

G. Procedure to Locate and Rectify a Leak.

(1) A reheat fuel flowmeter seal failure drains outlet connection leak indicates either or both of the following:

(a) Defective seal at the flowmeter fuel inlet connection.

(b) Defective seal at the flowmeter fuel outlet connection.

(2) Inlet elbow seal failure drains connection leakage. Refer to 73-11-01, Adjustment/Test to identify defective seals.

(3) Renew a defective seal or component and then repeat the pressure test and leak check.

H. Remove Test Equipment and Install/Connect Engine Components.

(1) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.D. as detailed for the removal and installation of the following items of test equipment and engine components respectively.

NOTE: If an engine is to be inhibited, refer to 70-00-07, Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(a) PE.20757 - blank and PE.27277 - clamp ring. Remove blank and clamp ring and reconnect the aircraft/engine main fuel connection.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B.OL.593-73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve). Remove hose and adapter and install drain valve.

(c) PE.29937 - blanking plug. Remove plug and install blanking ferrule at ejector pump.

(d) PE.35666 - drain adapter. Remove adapter and install the blanking plug in the actuator gearbox.

(e) AS.15826 - blanking units. Remove blanks and connect fuel tubes to the tube junction.

R (f) 9970-531-043 - adapter. On engines No.1 or 3
R remove adapter and connect purge air tube to
R reheat purge solenoid valve.

R (g) 9970-521-075-adapter. On engines No.2 or 4
R remove adapter and connect purge air tube to

R reheat purge valve.

R (h) - Blank. Remove blank and connect
R purge air/fuel tube.

(2) Connect seal failure drains system at reheat flowmeter connection.

(a) Apply lubricant A to attachment items.

(b) Assemble a new seal washer to each side of the connector and secure in position with the fluid passage bolt torque-tightened to between 150 and 170 lbf in. (17 and 19,2 N.m).

(c) Wire-lock fluid passage bolt and union nuts.

(3) Carry out a final leak check.

(a) Remove the safety clips and reset circuit breakers. (Ref.73-23-01, Removal/Installation, Table 401).

(b) Ensure that all fuel connections are secure, open the LP fuel isolation valve and start the appropriate aircraft fuel feed pumps.

(c) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valves, blanking ferrules and the aircraft/engine connections under test. No leaks are acceptable.

(e) On completion of check, switch off pumps.

(4) PE.20748 - drain adapter. Remove drain adapter from inlet elbow and connect the seal drains system as detailed in 73-00-00, Adjustment/Test, paragraph 6.D.

(5) Complete the procedure as detailed in 73-23-01, Removal/Installation

REHEAT PURGE VALVE TRANSDUCER - REMOVAL/INSTALLATION

1. Reheat Purge Valve Transducer (Ref. Fig. 401)

A. Prepare to Remove Transducer.

(1) Open engine bay lower doors (Ref.71-00-00, Servicing).

B. Remove Transducer.

(1) Unscrew bolts securing both electrical lead clips to support bracket and detach clips.

(2) Disconnect electrical connector from transducer.

(3) Unscrew bolts securing the transducer, support bracket and spacers to the reheat fuel control unit and remove bracket and spacers.

(4) Withdraw the transducer.

C. Install Transducer.

(1) Position the transducer on the reheat fuel control unit as shown in the illustration (Ref. Fig. 401) and align the attachment holes.

(2) With support bracket and spacers in position secure the transducer with three bolts, install the two longer bolts at bracket positions. Torque-tighten bolts to 4,2 N.m (37 lbf in.).

(3) Wire-lock three bolts together.

(4) Connect and tighten electrical connector.

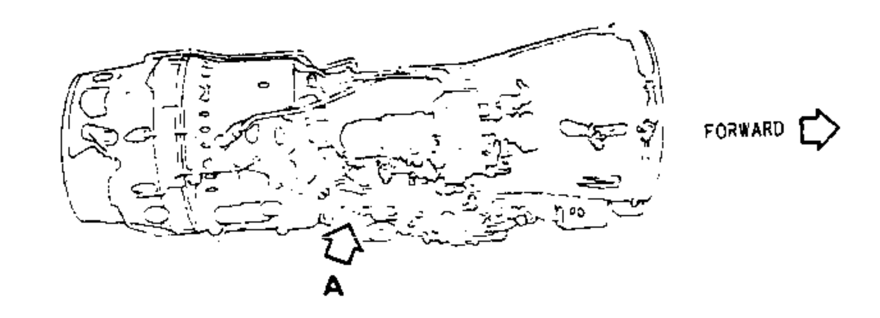
(5) With lubricant B applied, secure the electrical lead clips to support bracket with two bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

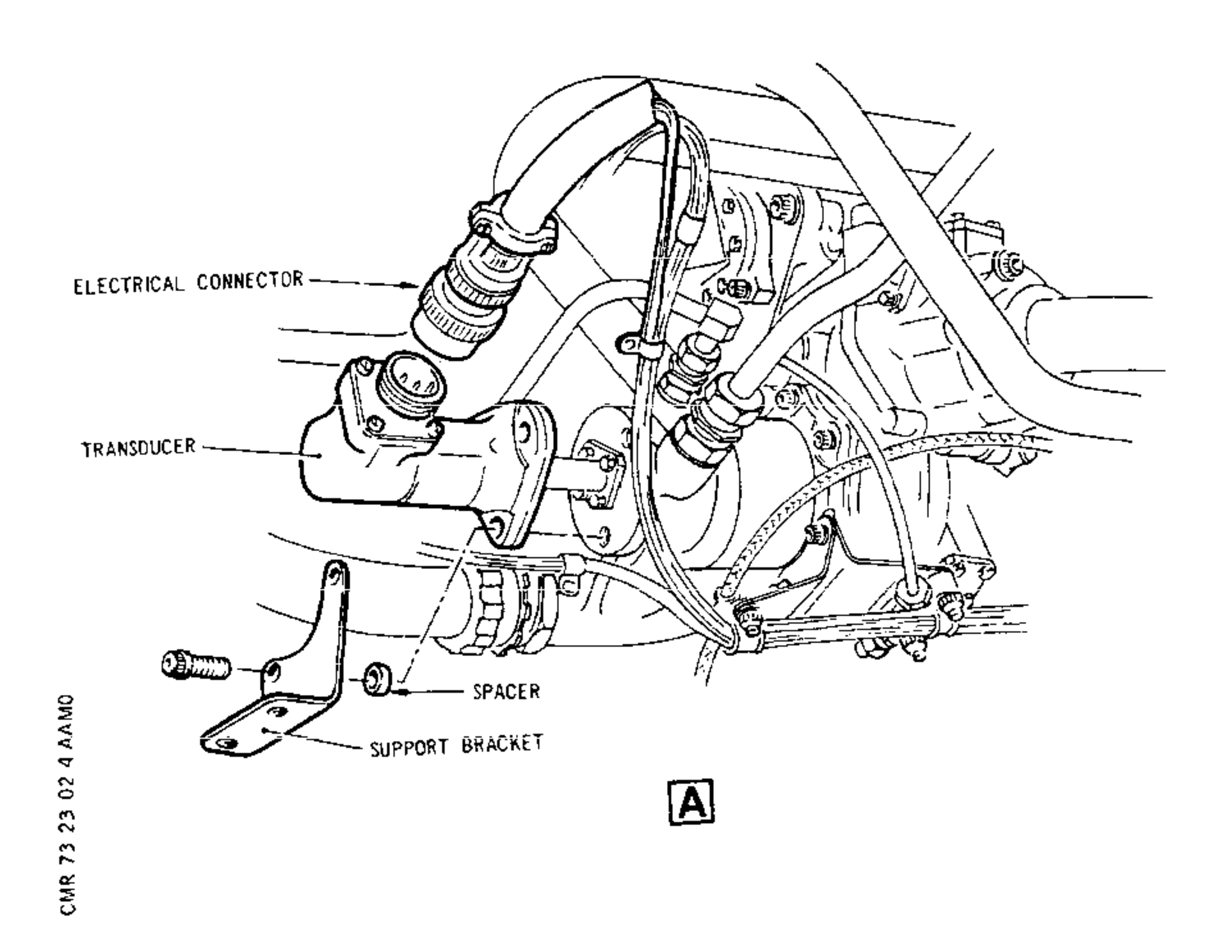
D. Complete Installation.

(1) Close engine bay lower doors (Ref.71-00-00, Servicing).

(2) Check for correct functioning of detection circuit, follow procedure detailed in 76-15-00, Adjustment/Test.

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Reheat Purge Valve Transducer
Figure 401

REHEAT METERING VALVE MOTOR - REMOVAL/INSTALLATION

1. General.

This topic describes the procedures for Removal/Installation of the electrical Reheat Metering Valve Motor.

2. Removal/Installation of the Reheat Metering Valve Motor.

A. Equipment and Materials.

DESCRIPTION	PART No.
Air bleed tube	PE. 22898
Drain tube (Pre S.B. OL.593-73-1 drain valve).	PE. 34076
Drain tube (S.B. OL. 593-73-1 drain valve).	PE. 26796
Drain tube for heater and filter drain valve.	PE. 21970
Circuit-breaker safety clips	-
Anti-seizure compound.	Lubricant A and J (Ref.70-00-01).

B. Prepare to Remove the Reheat Metering Valve Motor.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows "SHUT".

(2) Electrically isolate the engine services indicated in Table 401 by tripping the circuit-breakers affecting the engine upon which work is to be carried out. Fit circuit-breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENGINE No. 1			
LP VALVE SUP 1	15-216	1Q1	C1
LP VALVE SUP 2	16-215	1Q2	-
REHEAT AMP SUP	14-215	1K1541	C12
REHEAT CONT	15-216	1K1542	E9
ENGINE No. 2			

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LP VALVE SUP 1	15-216	2Q1	F2
LP VALVE SUP 2	15-215	2Q2	C19
REHEAT AMP SUP	13-215	2K1541	B14
REHEAT CONT	13-215	2K1542	D15
ENGINE No. 3			
LP VALVE SUP 1	15-216	3Q1	F1
LP VALVE SUP 2	15-215	3Q2	C20
REHEAT AMP SUP	13-216	3K1541	B7
REHEAT CONT	15-215	3K1542	D16
ENGINE No. 4			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-
REHEAT AMP SUP	14-216	4K1541	D7
REHEAT CONT	15-216	4K1542	E10

Circuit-Breakers
Table 401

(3) Open engine bay lower doors (Ref. 71-00-00, Servicing).

(4) Drain the engine fuel system.

(a) Open air bleed valve to expedite draining.

(b) Use drain tube PE. 34076 (Pre S.B. OL. 593-73-1 drain valve) or PE. 26796 (S.B. OL. 593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE. 21970 at the fuel heater and filter drain valve. Direct free ends of drain tubes into a container and drain the system upstream of the FCU.

(c) Remove blanking ferrule at reheat fuel filter.

(c1) Break wire-locking, loosen blanking ferrule and allow fuel to drain into a container.

(c2) When draining is complete, remove blanking ferrule, apply lubricant A, re-assemble ferrule and torque-tighten to between 2,15 and 2,35 daN.m

(190 and 210 lbf.in.). Wire-lock ferrule to blanking plate.

(d) When fuel draining ceases, remove the drain tubes and close the bleed valve.

NOTE : Discard drained fuel or inhibiting fluid.

(5) On engines installed in No. 1 or No. 3 bays, detach the electrical harness support tray and tie-rod at the engine-mounted brackets (Ref. 71-00-12, Removal/ Installation).

(6) Disconnect electrical connector from Reheat Purge Valve Transducer (Ref. Fig. 401).

(7) Unscrew union nuts and detach both, purge air inlet and purge air/fuel spill tubes from the reheat purge valve (Ref. Fig. 401).

C. Remove the Reheat Metering Valve Motor (Ref. Fig. 401).

(1) Disconnect electrical connector from Reheat Metering Valve Motor.

(2) Unlock and unscrew the three bolts securing the Reheat Metering Valve Motor to the Reheat Fuel Controller.

(3) Withdraw and remove the Reheat Metering Valve Motor without rotatting it and taking care of the metallic O'ring.

(4) Leave the metallic O'ring in position.

CAUTION : DO NOT REMOVE THE METALLIC O'RING - THE LATTER, IF REMOVED, CAN NOT BE RE-USED.

D. Prepare to Install the Reheat Metering Valve Motor.

(1) Check that the metallic O'ring is in good condition ; if not, replace it as follows :

(a) Remove the damaged metallic O'ring using a wooden spatula so as to avoid damage to the ring recess.

(b) Using trichloroethane, degrease and clean the new O'ring and its recess. Wear gloves

to avoid finger marks.

CAUTION : TAKE CARE NOT TO SPILL TRICHLOROETHANE ON OTHER PARTS OF THE REHEAT FUEL CONTROLLER.

(c) Press the O'ring in its recess without undue force.

E. Install the Reheat Metering Valve Motor (Ref. Fig. 401).

(1) Taking care of the metallic O'ring position correctly and engage the reheat metering valve motor in its cavity.

(2) Push carefully reheat metering valve motor fully home in its cavity, thus ensuring that the toothed-wheel of the electrical motor is properly engaged in the reheat throttle valve reduction gearbox.

CAUTION : MAKE SURE THAT THE REHEAT METERING VALVE MOTOR IS FULLY ENGAGED IN ITS CAVITY BEFORE TIGHTENING THE MOUNTING BOLTS.

(3) Apply lubricant J to the three mounting bolts and torque tighten to 0,90 daN.m (80 lbf.in.).

(4) Wire-lock the three bolts together.

(5) Connect the electrical connector to the Reheat Metering Valve Motor and wire-lock.

F. Complete the Installation (Ref. Fig. 401).

(1) Connect both, purge air/fuel spill and purge air inlet tubes to the reheat purge valve.

(a) Apply lubricant A to both union connections.

(b) Connect purge air/fuel spill tube, screw on union nut and torque tighten to between 1,60 and 1,80 daN.m (140 and 160 lbf.in.).

(c) Connect purge air inlet tube, screw on union nut and torque-tighten to between 2,15 and 2,25 daN.m (190 and 210 lbf.in.).

(d) Wire-lock both union nuts at purge valve.

SHUT-OFF VALVE SOLENOID ELECTRICAL CONNECTION

A

A

REHEAT FUEL CONTROLLER

PURGE AIR AND FUEL SPILL OUTLET TUBE

PURGE VALVE TRANSDUCER ELECTRICAL CONNECTION

REHEAT METERING VALVE MOTOR ELECTRICAL CONNECTION

PURGE AIR INLET TUBE

A

METALLIC O'RING

REHEAT METERING VALVE MOTOR

CMS 73 23 03 4 AAMO

Reheat Metering Valve Motor - Removal/Installation
Figure 401

(2) Connect electrical connector to the Reheat Purge Valve Transducer and Wire-lock.

G. Electrical Operational Test of the Reheat Metering Valve Motor.

(1) Carry out the Electrical Test of the Reheat Metering Valve Motor, using either the Reheat Test Box or Reheat Test Set.

(a) Operational test using the Reheat Text Box - comply with the procedures given in 73-23-03, Adjustments/Test, paragraph 2.

(b) Operational test using the Reheat Test Set - comply with the procedures given in 73-23-03, Adjustments/Test, paragraph 3.

H. Check for Leaks at Connections Disturbed during Removal/Installation Procedures.

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure - comply with the procedures given in 73-23-03, Adjustments/ Tests, paragraph 4.

(b) PTIR pressure - comply with the procedures given in 73-23-03, Adjustments/Tests, paragraph 5.

(c) On completion of a static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph J. Operations (2) and (4).

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph J.

J. Restore Engine to Flight Standard

(1) If a leak check is to be made during an engine run, carry out a preliminary leak check using the aircraft fuel feed pumps.

(a) Remove safety clips, reset circuit-breakers (ref. Table 401) and open the LP fuel isolation valve.

(b) Install air bleed tube PE. 22898 ; start appropriate aircraft fuel feed pumps and bleed all air from the system.

(c) When air-free fuel flows, close the bleed valve and torque-tighten to between 1,13 and 1,24 daN.m (100 and 110 lbf.in.) with lubricant A applied. Remove bleed tube.

(d) Check for signs of leakage at bleed valve, reheat metering valve motor, inlet elbow drain valve, fuel heater and filter drain valve, and blanking ferrule at reheat fuel filter. No leaks are acceptable.

(e) On completion of check, switch-off the aircraft fuel feed pumps.

(f) Install the bleed and drain valve caps.

(f1) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(f2) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(2) On engines installed in No. 1 or No. 3 bays, secure electrical harness support tray and tie-rod to the engine-mounted brackets (Ref. 71-00-12, Removal/Installation).

(3) If the fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit-breakers tripped for the opening of the engine bay doors (Ref. 71-00-00, Servicing) that are required for the engine run checks, and comply with the procedures of 73-00-00 and 71-00-00, Adjustments/Tests, respectively. On completion of engine run, re-set circuit-breakers and attach safety clips.

(4) Close engine bay doors (Ref. 71-00-00, Servicing).

REHEAT METERING VALVE MOTOR - ADJUSTMENT TEST

1. General.

This chapter is complementary to the Removal/ Installation of the Reheat Metering Valve Motor and details the procedures to be carried out for operational test and leak checks by application of a static pressure.

The electrical operational test of the reheat metering valve electrical motor is carried out by using either the Reheat Test Box or the Reheat Test Set, details and procedures being given in paragraph 2 and 3. Leak checks by application of a static pressure, using the aircraft fuel feed pumps, is described in paragraph 4 while leak checks, using the pressure test and inhibiting rig (PTIR), are detailed in paragraph 5.

2. Operational Test Of the Reheat Metering Valve Motor Using the Reheat Test Box.

A. Equipment and Materials.

DESCRIPTION	PART NO.
Reheat Test Box	9970-531-044
Circuit-breaker safety clips	-

B. Prepare to Carry out the Operational Test.

(1) Position the main throttle lever fully forward.

(2) Switch on the REHEAT switch at pilot station.

(3) Ensure that the reheat system supply circuit-breakers are set on the engine on which work is going to be carried out (Ref. Table 501).

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No. 1 REHEAT AMP SUP	14-215	1K1541	C 12

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
REHEAT CONT	15-216	1K1542	E 9
ENGINE No. 2			
REHEAT AMP SUP	13-215	2K1541	B 14
REHEAT CONT	15-215	2K1542	D 15
ENGINE No. 3			
REHEAT AMP SUP	13-216	3K1541	B 7
REHEAT CONT	15-215	3K1542	D 16
ENGINE No. 4			
REHEAT AMP SUP	14-216	4K1541	D 7
REHEAT CONT	15-216	4K1542	E 10

Circuit-Breakers
Table 501

(4) Electrically isolate the Reheat Ignition supply by tripping the circuit-breakers affecting the engine upon which work is carried out (Ref. Table 502). Fit circuit-breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE NO. 1			
REHEAT IGN SUP PH A	14-215	1K1543	B 13
REHEAT IGN SUP PH C	14-215	1K1544	F 12
ENGINE No. 2			
REHEAT IGN SUP PH A	13-215	2K1543	A 14
REHEAT IGN SUP PH C	13-215	2K1544	E 14
ENGINE No. 3			
REHEAT IGN SUP PH A	13-216	3K1543	A 5
REHEAT IGN SUP PH B	13-216	3K1544	F 6
ENGINE No. 4			
REHEAT IGN SUP PH A	14-216	4K1543	A 6

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
REHEAT IGN SUP PH B	14-216	4K1544	E 7

Circuit-Breakers
Table 502

C. Connect the Reheat Test Box to the Reheat Control Amplifier (Ref. Fig. 501).

(1) Check that all the test box switches are set to off.

(2) Connect the test box to the reheat control amplifier test connector.

(3) Switch on the test box POWER SUPPLY switch and check that the 28V DC, 115V/400 Hz and ALPHA 10 % THROTTLE LEVER lights illuminate.

(4) Depress the test box LIGHT TEST push-button and check that all the test box lights illuminate.

D. Operational Test of the Reheat Metering Valve Motor.

(1) Switch on Fr and check that the corresponding light illuminates.

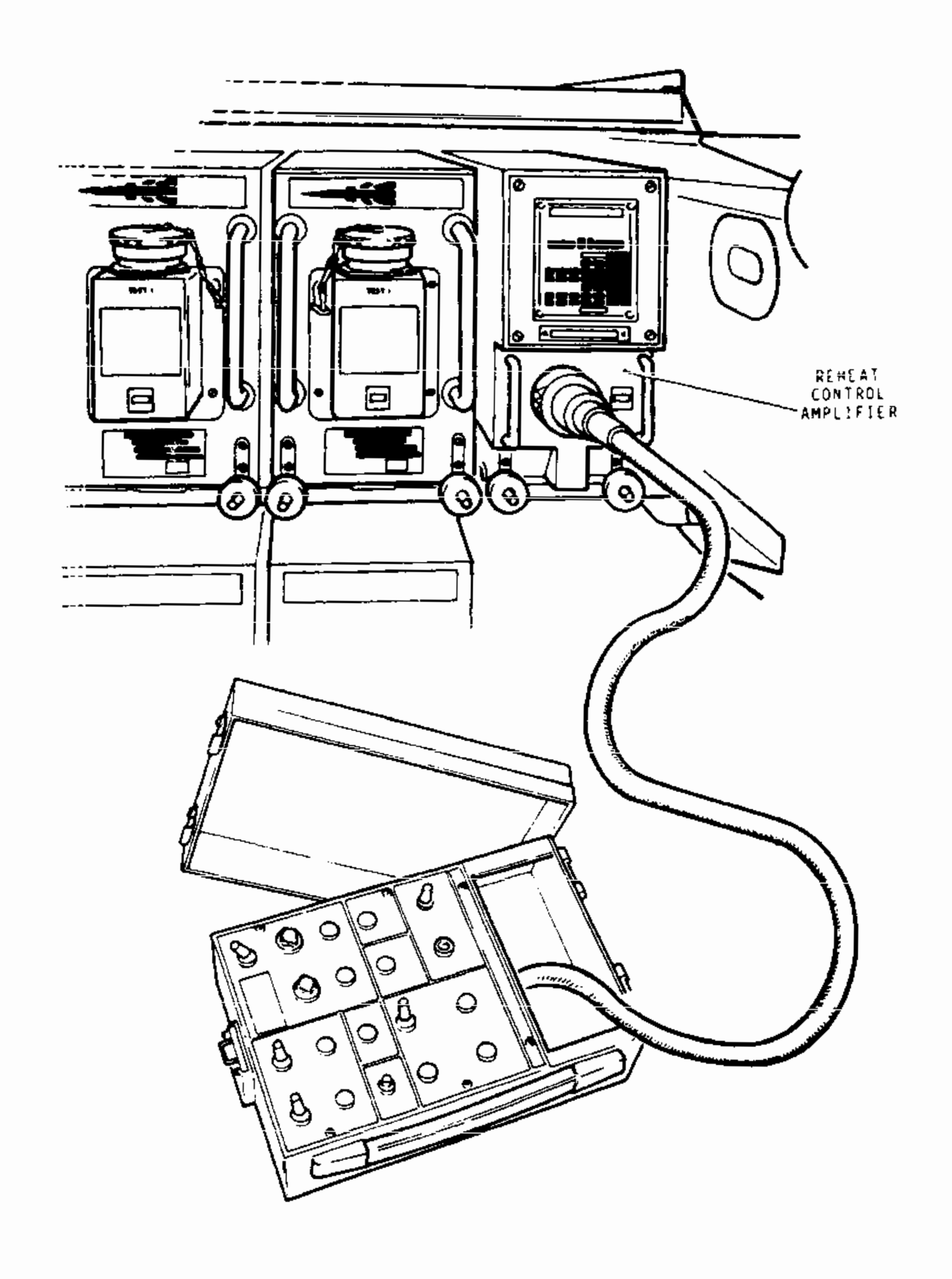
(2) Switch on N1 and check that the corresponding light illuminates.

(3) Check the operation of the reheat metering valve motor by observing the REHEAT THROTTLE MOTOR indicator lights when actuating the Fe GENERATOR switch.

(a) Switch on Fe GENERATOR and check that the OPENING indicator light illuminates (short duration).

(b) Switch off Fe GENERATOR and check that the CLOSING indicator light illuminates (short duration).

E. Conclusion.



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Reheat Test Box Connected to Reheat Control Amplifier
Figure 501

(1) Switch off all test box switches.

(2) Switch off the reheat switch at the pilot station.

(3) Position the main throttle lever back to the idle position.

(4) Remove circuit-breaker safety clips and reset the circuit-breakers (Ref. Table 502).

(5) Disconnect the test box from the reheat control amplifier.

3. Operational Test Of the Reheat Metering Valve Motor Using the Reheat Test Set.

A. Equipment and Materials.

DESCRIPTION	PART NO.
Reheat Test Set	9970-531-034
Circuit-breaker safety clips	-

B. Prepare to carry out the Operational Test.

(1) Position the main throttle lever fully forward.

(2) Switch on the REHEAT switch at pilot station.

(3) Ensure that the reheat system supply circuit-breakers are set on the engine on which work is going to be carried out (Ref. Table 501).

(4) Electrically isolate the Reheat Ignition supply by tripping the circuit-breakers affecting the engine upon which work is carried out (Ref. Table 502). Fit circuit-breaker safety clips.

C. Connect the Reheat Test Set to the Reheat Control Amplifier (Ref. Fig. 502).

(1) Prepare the Test Set.

(a) Place the mode selector on MAN.

(b) Switch off the ON/OFF TEST SET switch.

(c) Switch off Tt1 - Fe - Fr - N1 switches.

(2) Connect the test set to the reheat control amplifier.

(3) Depress the TEST IND LIGHTS test set push-button and check that all the indicating lights illuminate.
Amplifier

D. Operational Test of the Reheat Metering Valve Motor.

(1) Switch on TEST SET ON/OFF for supply and check that 28V-115V and ALPHA 10 % indicating lights illuminate.

(2) Switch on - Tt1 - Fe - Fr - N1 switches.

(3) Place the A.C. selector in position MOTOR CONT.

(4) Adjust N1 to a value equal to or less than 1000 Hz.

(5) Adjust Fr to 55 Hz.

(6) Adjust Fe to 100 Hz.

(7) Adjust Tt1 to 5.8 volts.

(8) Increase progressively N1 until 90 % indicating light goes on. The N1 value must be between 3435 and 3470 Hz.

(9) Check that METERING VALVE OPEN indicating light goes on simultaneously and check for existing TACHO GENE output voltage on the digital voltmeter. (short duration).

(10) Switch off REHEAT at pilot station and check that METERING VALVE CLOSED goes on, check for existing TACHO GENE output voltage (short duration).

E. Conclusion.

(1) Switch off all test set switches.

(2) Position the main throttle lever back to the idle position.

(3) Remove circuit-breaker safety clips and reset the circuit-breakers (Ref. Table 502).

(4) Disconnect the test set from the reheat control

REHEAT CONTROL AMPLIFIER

REHEAT TEST SET

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Reheat Test Set Connected to Reheat Control
Figure 502

amplifier.

4. Leak Check with Aircraft Fuel Feed Pumps.

A. General.

The Reheat Fuel Controller after removal/installation of the Reheat Metering Valve Motor is leak checked, using the appropriate aircraft fuel feed pumps, in conjunction with the procedures detailed in 73-00-00, Adjustment/Test.

B. Equipment and Materials.

DESCRIPTION	PART NO.
Air bleed tube.	PE. 22898
Anti-seizure compound	Lubricant A (Ref. 70-00-01)

C. Leak Check of the Reheat Fuel Controller.

(1) Remove the circuit-breaker safety clips and reset the circuit-breakers on the engine on which work is going to be carried out (Ref. Table 503).

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ENGINE No. 1			
LP VALVE SUP 1	15-216	1Q1	C 1
LP VALVE SUP 2	16-215	1Q2	-
ENGINE No. 2			
LP VALVE SUP 1	15-216	2Q1	F 2
LP VALVE SUP 2	15-215	2Q2	C 19
ENGINE No. 3			
LP VALVE SUP 1	15-216	3Q1	F 1
LP VALVE SUP 2	15-215	3Q2	C 20
ENGINE No. 4			
LP VALVE SUP 1	15-216	4Q1	C 2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
LP VALVE SUP 2	16-215	4Q2	-

Circuit-Breakers
Table 503

(2) Ensure that all fuel connections are secure, open the LP fuel valve and start the appropriate aircraft fuel feed pumps.

(3) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When air-free fuel flows, close the bleed valve and torque-tighten to between 1,13 and 1,24 daN.m (100 and 110 lbf.in.) with lubricant A applied. Remove bleed tube.

(4) With feed pump pressure applied, check for signs of leakage at Reheat Metering Valve Motor, inlet elbow drain valve, fuel heater and filter drain valve, blanking ferrule at reheat fuel filter and air bleed valve No leaks are acceptable.

(5) On completion of check, switch off the aircraft feed pumps.

(6) Reinstall the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to the air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the fuel inlet elbow drain valve and fuel heater and filter drain valve. Tighten and wire-lock each cap.

(7) Complete the Removal/Installation procedure as detailed in 73-23-03 Removal/Installation.

5. Leak Check Using PTIR.

A. General.

This paragraph details the procedure for a pressure test

and leak check using the PTIR and pressure test equipment. On completion of the PTIR checks, a final leak check is required on an engine using the aircraft fuel feed pumps to check remade connections after removal of test equipment.

B. Equipment and Materials.

DESCRIPTION	PART NO.
Pressure test and inhibiting rig (PTIR)	PE.17988
Pressure test equipment items (contained in adapter set PE.22964) are required as follows :	
Air bleed tube	PE.22898
Adapter (Pre S.B. OL. 593-73-1 drain valve)	PE.22972
Adapter (S.B. OL. 593-73-1 drain valve)	PE.26710
Blank	PE.20757
Blanking unit (2)	AS.15826
Blanking plug	PE.29937
Clamp	PE.27277
Drain adapter	PE.20748
Drain adapter	PE.35666
Hose	PE.22893
Aviation kerosine	D.Eng.R.D.2494
or	
Inhibiting fluid	DEF.2001 A or D.Eng. R.D. 2490
Anti-seizure compound	Lubricant A and B (Ref. 70-00-01)

C. Install Pressure Test Equipment.

CAUTION : ENSURE TEST EQUIPMENT IS CLEAN AND SERVICEABLE BEFORE INSTALLING ON ENGINE.

(1) PE.20757 - blank and PE.27277 - clamp. Install pressure test blank in the fuel inlet elbow (Ref. Fig. 503), Detail A.

(a) Disconnect aircraft/engine main fuel connection or remove the protective blank from the inlet elbow of an uninstalled engine.

(b) Detach protective cover, ensure blank unit sealing ring is serviceable and press unit into fuel inlet elbow bore.

(c) Position clamp over blank and elbow flanges and tighten securely.

(2) PE.22893 - hose and PE.22972 - adapter (Pre S.B. OL. 593-73-1 drain valve) or PE.26710 - adapter (S.B. OL. 593-73-1 drain valve). Assemble hose and adapter to fuel inlet elbow drain valve location (Ref. Fig. 503), Detail A.

(a) Pre S.B. OL. 593-73-1 drain valve - install adapter PE.22972.

(a1) Remove attachment bolts and detach drain valve.

(a2) Insert a serviceable seal plate and secure adapter to elbow at valve location with three bolts torque-tightened to between 0,76 and 0,82 daN.m (67 and 73 lbf.in.) with lubricant B applied.

(b) S.B. OL. 593-73-1 drain valve - install adapter PE.26710.

(b1) Screw adapter securely to drain valve. This action opens the valve.

(c) Connect hose to installed adapter, tighten securely and support hose with strap.

(3) PE.29937 - blanking plug. Install in the return fuel at outlet to ejector pump/first stage pump (Ref. Fig. 503), Detail E.

(a) Remove blanking ferrule from return tube test connection, insert blanking plug and retain with connection union nut firmly tightened.

(4) PE.35666 - drain adapter. Install in the throttle valve actuator gearbox spill/drain adapter in the actuator casing (Ref. Fig. 503), Detail B. During this operation keep fluid loss at a minimum so that the actuator remains primed.

(a) Remove drain plug from actuator gearbox rear face.

(b) Remove drain tube from adapter, install adapter with seal washer and tighten firmly.

(c) Assemble drain tube to adapter with seal washer interposed.

(5) PE.20748 - drain adapter. Assemble drain adapter to fuel inlet elbow drain connection (Ref. Fig. 503), Detail A.

(a) On engines to Pre. S.B. OL.593-71-10 standard, remove seal failure drains system fluid passage pillar bolt and detach connector complete with drain tubes.

(b) On engines to S.B. OL.593-71-10 standard detach seal failure drains tube from fluid passage bolt, remove the bolt and detach connector complete with drain tube.

(c) Assemble a serviceable seal washer to the adapter and install it in the drain outlet connection.

(6) AS.15826 - blanking units. Install items on fuel atomizing pilot nozzle tube junction connections (Ref. Fig. 503), Detail F.

(a) Detach the two fuel atomizing pilot nozzle tubes from the junction of the tube from distribution block/dump valve.

(b) Detach clamp assembly securing left-hand tube to support bracket to give clearance when installing the blanking plug.

(c) Screw blanking units on the tube junction connections and torque-tighten to between 2,15 and 2,37 daN.m (190 and 210 lbf.in.) with lubricant A applied.

(7) Direct free ends of drain tubes into a container.

D. Pressure Test Procedure.

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with

CLAMP
BLANK
FUEL INLET ELBOW
A
B
INLET ELBOW DRAIN
ADAPTER
DRAIN VALVE
ADAPTER
SB.73-1
COVER
HOSE ASSEMBLY
SEALING RING
ADAPTER
PRE SB.73-1
THROTTLE VALVE
ACTUATOR GEARBOX
DRAIN ADAPTER ASSEMBLY
(INCORPORATING RELIEF VALVE)
B

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Installation of Test Equipment and Location
(Sheet 1 of 2)
Figure 503

EJECTOR PUMP OUTLET

BLANKING PLUG

FIRST STAGE PUMP

E

BLANKING PLUG

FUEL ATOMIZING PILOT
NOZZLE TUBE JUNCTION

F

BLANKING PLUG

CMS 73 23 03 5 CAMB

Installation of Test Equipment and Location
(Sheet 2 of 2)
Figure 503

its general procedure and safety precautions.

(b) Couple a self-sealing hose of the test rig to the installed test adapter hose at the inlet elbow.

(c) Verify that the weight of the hose is supported and all connections are secure before commencing test procedure.

(d) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence the test procedure.

(2) Bleed all air from the system and continue with the low pressure test, paragraph (3).

(a) Operate the test rig and apply a pressure of 207 KPa (30 psig).

(b) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When air-free fuel flows, close the bleed valve and remove air bleed tube.

(3) Carry out the low pressure test.

(a) Continue to apply pressure at 207 KPa (30 psig) and complete the low pressure test. Check for signs of leakage at the Reheat Metering Valve Motor and drain adapter tubes and ensure that the following conditions are met before commencing the high pressure test.

(a1) No leakage is acceptable at the Reheat Metering Valve Motor.

(a2) No leakage is acceptable at the fuel inlet elbow drain adapter.

<u>NOTE</u> : A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

(a3) There should be no spill from the throttle actuator gearbox rear face drain adapter

since the relief-valve setting of the adapter is higher than the applied pressure.

(4) Continue with a high pressure test.

(a) Operate the test rig and increase the test pressure to 4137 KPa (600 psig).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

NOTE : If spill from actuator gearbox drain adapter appears excessive (100 cc/min maximum acceptable limit) carry out an accurate leak rate check as specified in 73-00-00, Adjustment/ Test.

(c) Reduce test pressure to zero and stop pump motor.

(5) On completion of pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hose. Open the bleed valve to expedite draining.

CAUTION : ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED. FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

E. Remove Test Equipment and Install/Connect Engine Components.

NOTE : If an engine is to be inhibited, refer to 70-00-07, Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(1) PE. 20757 - blank and PE. 27277 - clamp (Ref. Fig. 503), Detail A. Remove inlet connection blank and clamp ring and, on an installed engine, reconnect the aircraft/engine main fuel connection (Ref. 71-00-12, Removal/Installation). On an uninstalled engine, assemble the transit blank to the inlet connection aperture.

(2) PE. 22893 - hose and PE. 22972 - adapter (Pre S.B. OL. 593-73-1 drain valve) or PE. 26710

- adapter (S.B. OL. 593-73-1 drain valve) (Ref. Fig. 503), Detail A.

  (a) Unscrew union nut and disconnect hose from adapter at inlet elbow drain valve position, release support strap and remove hose from engine.

  (b) Pre S.B. OL. 593-73-1 drain valve - remove adapter and install drain-valve.

    (b1) Remove bolts and take off adapter and seal plate.

    (b2) Apply lubricant B to drain valve attachment bolts.

    (b3) Assemble drain valve and serviceable seal plate (Ref. 70-00-03, Sealing Devices) to inlet elbow location and retain in position with three bolts. Secure wire-locking washer, attached to pressure cap chain, with outer bolt.

    (b4) Torque-tighten the three bolts to between 0,76 and 0,82 daN.m (67 and 73 lbf.in.).

  (c) S.B. OL. 593-73-1 drain valve - remove adapter.

    (c1) Unscrew union nut and remove adapter from valve.

(3) PE. 29937 - blanking plug (Ref. Fig. 503), Detail E.

Remove blanking plug and install blanking ferrule at ejector pump.

  (a) Remove plug and assemble blanking ferrule and union nut to connection on return fuel tube and torque-tighten union nut to between 2,5 and 2,7 daN.m (220 and 240 lbf.in.) with lubricant A applied.

  (b) Wire-lock union nut.

(4) PE. 35666 - drain adapter (Ref. Fig. 503), Detail B. Remove adapter and install blanking plug. During this operation, keep fluid losses to a minimum to keep actuator gearbox primed.

(a) Remove adapter and install the blanking plug with a new seal washer in the throttle actuator gearbox rear face location.

(b) Torque-tighten plug to between 0,50 and 0,56 daN.m (44 and 50 lbf.in.). Wire-lock the plug.

(5) PE.20748 - drain adapter - (Ref. Fig. 503), Detail A.

(a) On an installed engine, the drain adapter is left in position ready for the final leak check using aircraft fuel feed pumps.

(b) On an uninstalled engine, remove drain adapter from inlet elbow and connect seal failure drains system as follows :

(b1) Apply lubricant A to attachment items.

(b2) Assemble a new seal washer to each side of the connector, secure in position with the fluid passage bolt and torque-tighten to between 1,7 and 1,92 daN.m (150 and 170 lbf.in.).

(b3) On engines to S.B. OL. 593-71-10 standard, connect seal drain tube to fluid passage bolt and triple torque-tighten thrust wire type union nut (Ref. 70-00-04, Torque-Tightening Technique) to between 1,02 and 1,15 daN.m (90 and 100 lbf.in.).

(b4) Wire-lock bolt and union nuts.

(6) AS.15826 - blanking units (Ref. Fig. 503), Detail F. Remove blanks and connect fuel atomizing pilot nozzle tubes.

(a) Remove blanks from fuel atomizing pilot nozzle tube junction.

(b) Apply lubricant A to tube union connections and lubricant B to clamp assembly bolt and nut.

(c) Screw tube union nuts to junction and torque-tighten to between 2,15 and 2,35 daN.m (190 and 210 lbf.in.).

(d) Wire-lock union nuts.

(e) Secure clamp assembly to mounting bracket with bolt washer and nut torque-tightened to between 0,96 and 1,07 daN.m (85 and 95 lbf.in.). Locate flat washer against clamp.

(7) Carry out a final leak check. Comply with procedure detailed in paragraph 4.C. and check for signs of leakage at reinstalled connections, fuel heater and filter drain valve, air bleed valve, blanking ferrule at reheat fuel filter and ejector pump, and drain tube at the inlet elbow. No leaks are acceptable.

(8) PE.20748 - drain adapter (Ref. Fig. 503), Detail A. Remove drain adapter from inlet elbow and connect the seal drains system as detailed in paragraph 5.E. Operation (5) (b).

(9) Reinstall the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to the air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the fuel inlet elbow drain valve and fuel heater and filter drain valve. Tighten and wire-lock each cap.

(10) Complete the Removal/Installation procedure as detailed in 73-23-03 Removal/Installation.

REHEAT PURGE SOLENOID VALVE - REMOVAL/INSTALLATION

1. Tools and Equipment

   Circuit breaker safety clip ... ... -

2. Solenoid Valve (Ref. Fig. 401)

   A. Prepare to Remove Valve.

      (1) On engines No. 1 and No. 3 - open engine bay front lower door (Ref.71-00-00, Servicing).

      (2) On engines No. 2 and No. 4 - open engine bay front doors (Ref.71-00-00, Servicing).

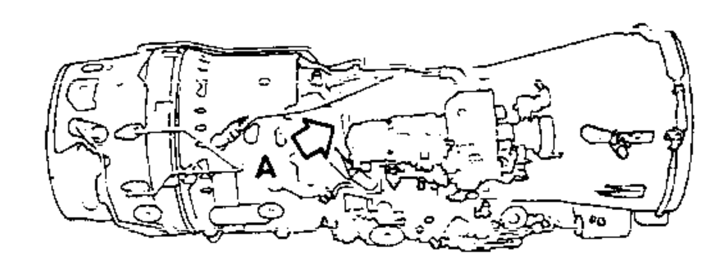
      (3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.1			
REHEAT AMP SUP	14-215	1K1541	C12
REHEAT CONT	15-216	1K1542	E9
Engine No.2			
REHEAT AMP SUP	13-215	2K1541	B14
REHEAT CONT	15-215	2K1542	D15
Engine No.3			
REHEAT AMP SUP	13-216	3K1541	B7
REHEAT CONT	15-215	3K1542	D16
Engine No.4			
REHEAT AMP SUP	14-216	4K1541	D7
REHEAT CONT	15-216	4K1542	E10

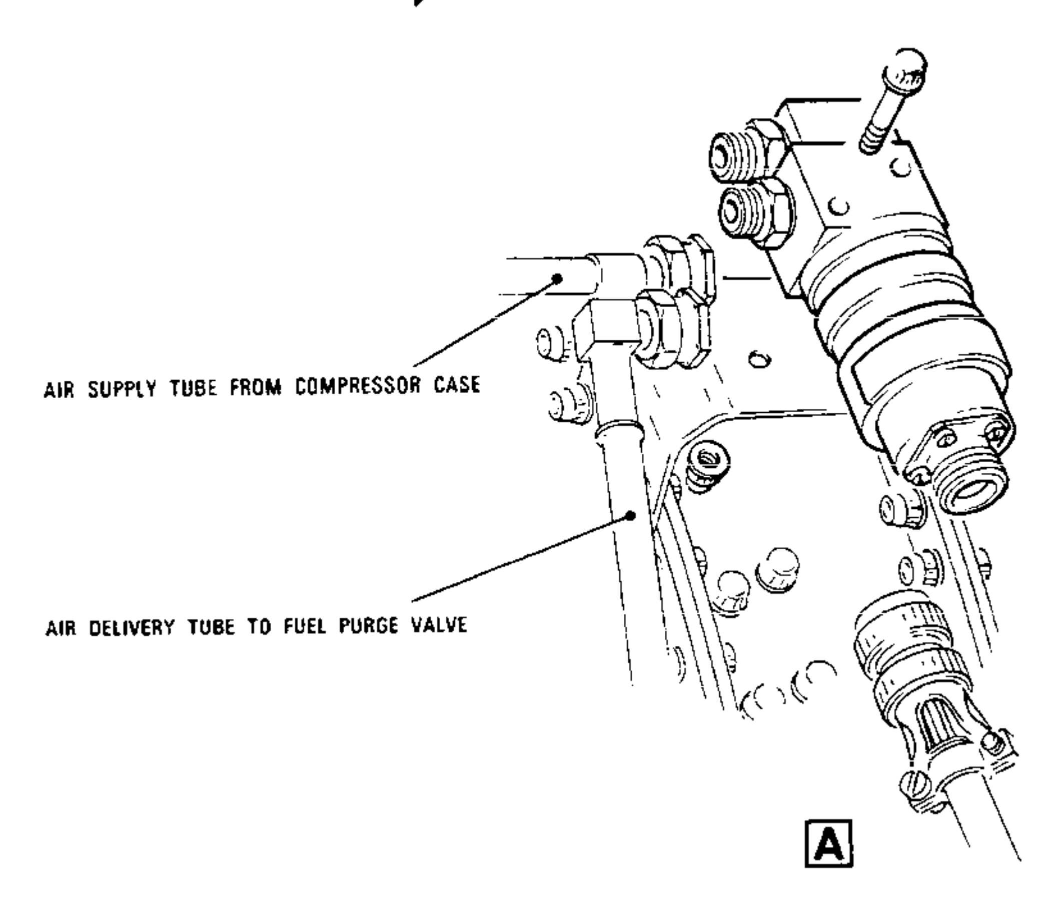
Circuit Breakers
Table 401

      (4) Disconnect electrical lead end plug from valve.

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CMR 73 24 01 4 AAMO

Solenoid Valve Location Detail
Figure 401

(5) Unscrew air tube union nuts from valve connections.

(6) Remove nuts and bolts and remove valve.

B. Install Valve

(1) Apply lubricant B (Ref.70-00-01, Servicing and Storage Materials) to valve attachment nuts and bolts.

(2) Position valve on engine with air connections in line with air tubes. Secure valve to mounting bracket with two bolts and nuts torque-tightened to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(3) Apply lubricant A to air tubes union connections and engage union nuts hand tight.

(4) Torque-tighten compressor case air supply tube union nut to between 140 and 160 lbf in. (15,8 and 18,1 N.m)

(5) Torque-tighten reheat system purge valve tube union nut to between 190 and 210 lbf in. (21,5 and 23,5 N.m).

(6) Wire-lock union nuts.

(7) Connect electrical lead end plug.

(a) On engines to Pre S.B.OL.593-71-15 standard, connect, tighten and wire-lock lead end plug.

(b) On engines to S.B.OL.593-71-15 standard, connect, tighten and ensure that a white line is painted across the connection join to indicate final tightened position.

C. Complete the Installation.

(1) Remove safety clips and reset circuit breakers listed in Table 401.

(2) On engines No.1 and No.3 - close engine bay front lower door (Ref.71-00-00, Servicing).

(3) On engines No. 2 and No. 4 - close engine bay front doors (Ref.71-00-00, Servicing).

INDICATING - DESCRIPTION AND OPERATION

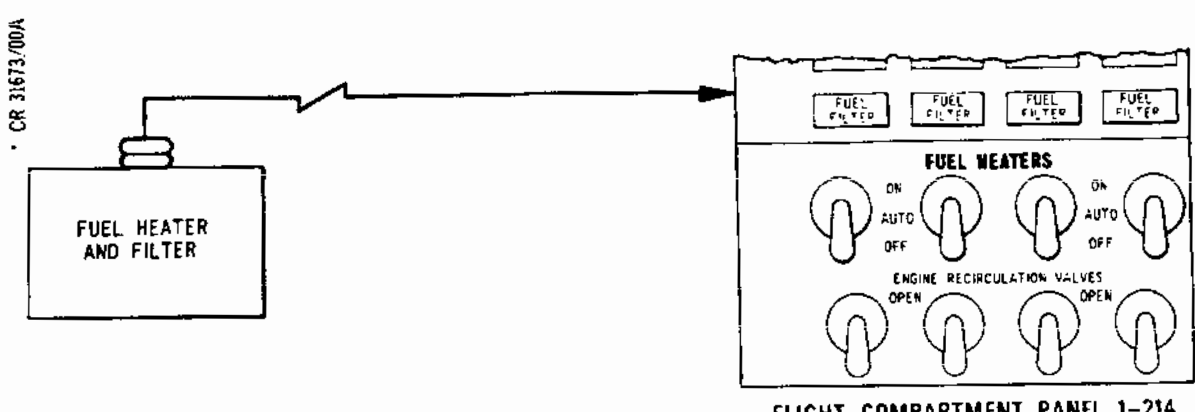
1. General

Indicating systems relay to the flight compartment indicators, the fuel differential pressure across the filter element, the
R fuel inlet temperature at the fuel pressure atomizing
R nozzle assemblies, fuel flow indication and the position
R of the HP shut-off valve.

2. Fuel Filter Differential Pressure Warning (Ref. Fig. 001)

The differential pressure switch is mounted on the fuel heater and filter in order to detect a rise in the fuel differential pressure across the filter element above 7 psi. Should this level be exceeded, due to filter blockage, the 28V d.c. switch contacts within the switch assembly close and activate a warning circuit. The maximum rating of the switch contacts is 0.5A at 28V d.c.

The differential pressure switch contacts are contained in a housing to which a hermetically sealed connector plug is attached. This housing is closed by a baseplate assembly and constitutes the low pressure or reference pressure chamber of the switch. The baseplate assembly is attached to the housing by means of four socket head screws. An assembly pin fitted to the baseplate assembly ensures the correct mounting of the switch. A port, marked H, in the mounting face of the baseplate provides entry to the high-pressure chamber of the differential switch. This high pressure chamber is machined in the baseplate and is separted from the low-pressure chamber by the capsule. Fuel is admitted to the low-pressure chamber by a second port marked L, in the mounting face of the baseplate. The capsule assembly includes a switch actuator which holds the moving contact of the switch away from the second (stationary) contact. The position of the second contact is set by means of an adjuster to obtain the appropriate contact gap for switch closure at the predetermined pressure difference level. Five equally spaced holes, situated around the flange of the pressure switch enable the component to be mounted on the fuel filter in the position determined by the assembly pin. The difference of the fuel pressure during normal operation is not sufficient to flex the capsule to a position at which the actuator allows the contacts to close. If the pressure in the fuel filter rises and increases the pressure difference to a nominal 7 psi, the capsule flexes enough to allow the contacts to close. This connects a 28V d.c. supply to the warning circuit to illuminate an amber FUEL FILTER caption on the flight compartment panel 1-214. The switch contacts remain closed until the fuel pressure differential is reduced below 7 psi. If this is not achieved by manual operation of



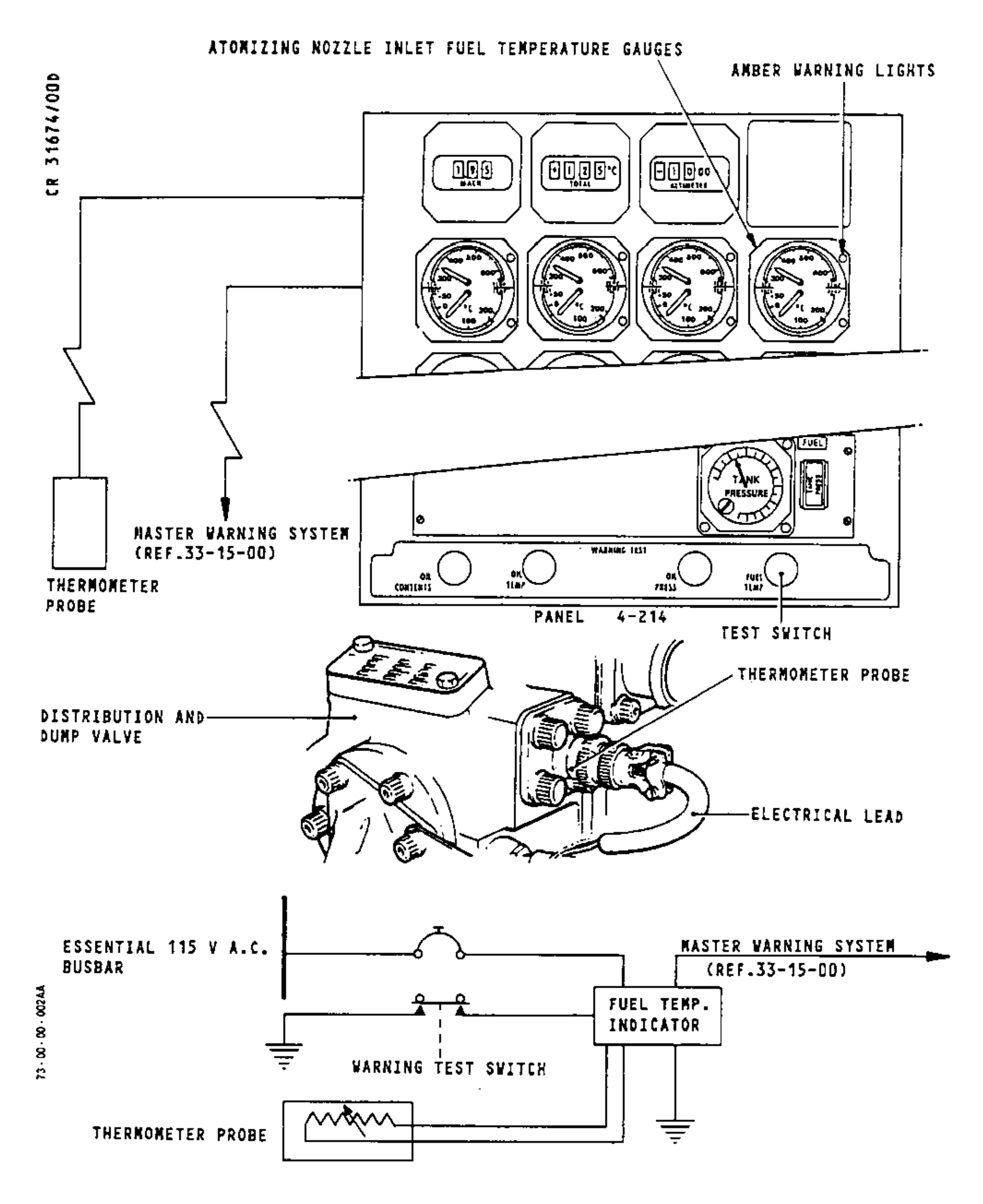
ADJUSTER ASSEMBLY
MOVING CONTACT ARM
DAMPER SPRING
CAPSULE
STATIONARY CONTACT ARM
HIGH PRESSURE
ELECTRICAL CONNECTOR
LOW PRESSURE
ACTUATING ARM
CERAMIC INSULATORS

FUEL HEATER AND FILTER
FUEL PRESSURE DIFFERENTIAL WARNING SWITCH

ESSENTIAL DC BUSBAR
A FUEL FILTER A

CMR 73 30 00 0 AAM0

Fuel Filter Differential Pressure
Warning Indication Details
Figure 001



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Fuel Inlet Temperature Indication Details
Figure 002

the fuel heater then either fuel heater malfunction or filter blockage due to foreign matter can be deduced.

3. Fuel Atomizing Nozzle Inlet Temperature (Ref. Fig. 002)

The fuel sprayers inlet thermometer is mounted at the bottom of the fuel distribution and dump valve face and connects electrically to the indicator on panel 4-214 in the flight compartment. The indicator is calibrated from minus 50 to plus 200 deg C.

Variations in the fuel temperature cause resistance changes in the thermometer probe which act on the indication system, this causes the indicator needle to traverse the dial. When the inlet fuel temperature exceeds plus 155 deg C a signal from the indicator circuit activates both an engine (ENG) amber caption on the master warning display on the pilot's roof panel 4-211, and an amber light on the indicator panel. A warning test switch (FUEL TEMP) is mounted on the bottom of the indicator panel 4-214, when pressed it will normally illuminate the amber light on the indicator panel and the engine amber light on the master warning display panel. The indicator is activated by a supply from the essential 115V a.c. busbar.

4. Fuel Flow Indication

The indication systems for fuel flow are detailed in 73-33-00. Systems are provided to relay to the flight compartment, the rate of fuel flow, the fuel consumption and the amount of fuel remaining.

5. HP Shut-Off Valve Position Indication (Ref. Fig. 003 and 004)

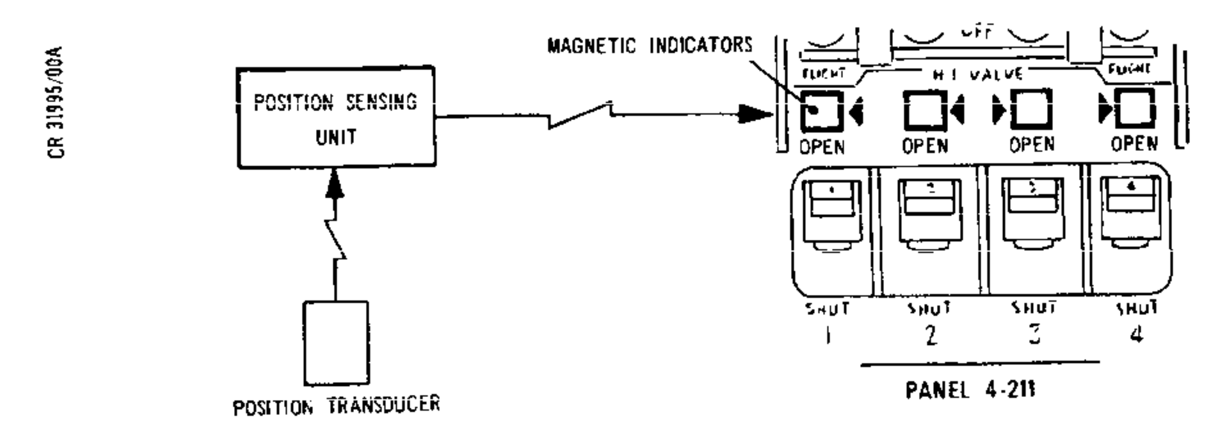
A. General

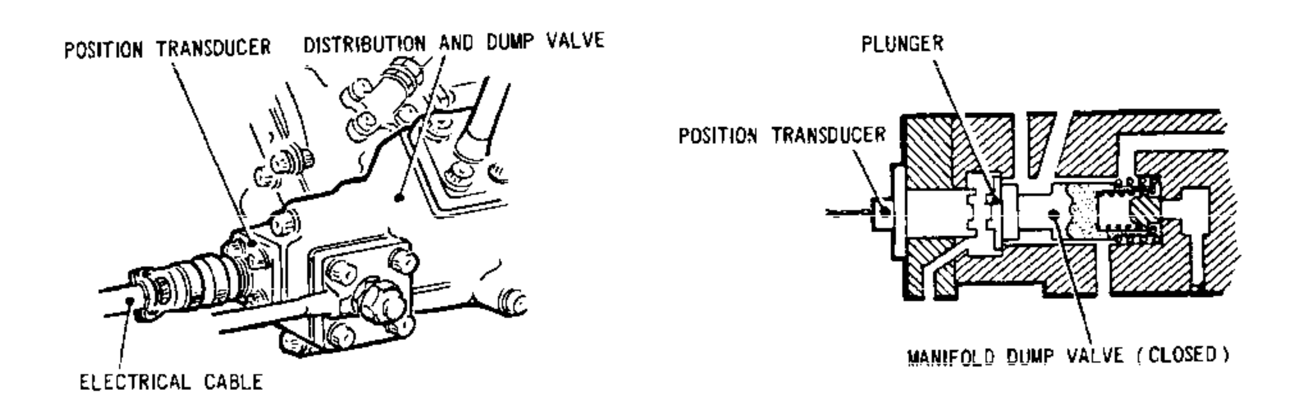
The HP shut-off valve position, open or closed, is displayed by a magnetic type indicator located above the HP VALVE control switches on the pilot's roof panel 4-211. The indication system incorporates a position transducer and a position sensing unit.

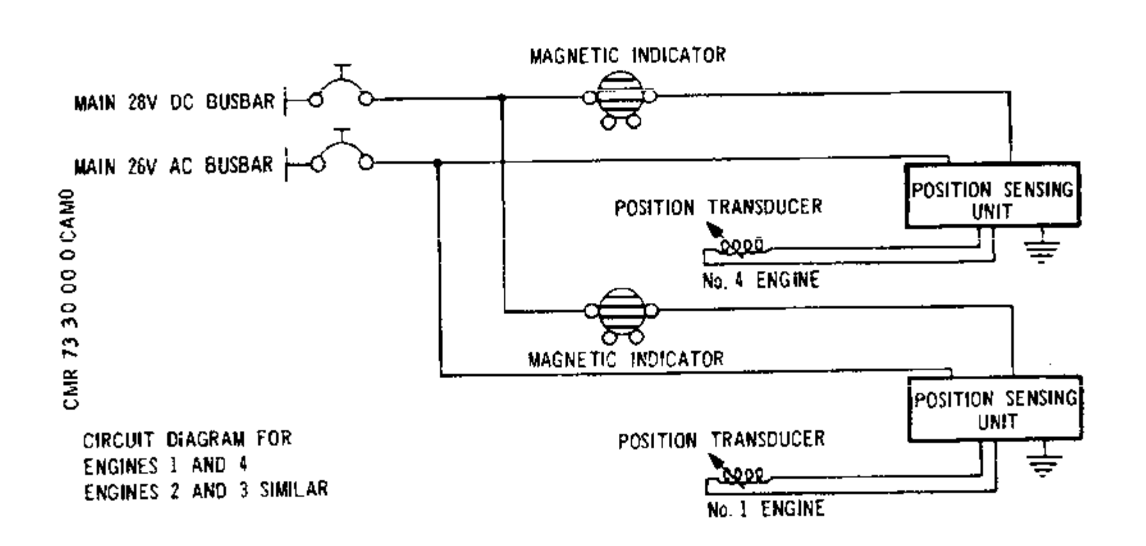
B. Position Transducer

The position transducer is installed in the end of the Manifold Dump Valve (MDV) locating bore in the distribution and dump valve. A plunger, screwed into the end of the MDV piston, is positioned so that the movement of the MDV piston permits the plunger to move in or out of the magnetic field of the position transducer.

C. Position Sensing Unit.

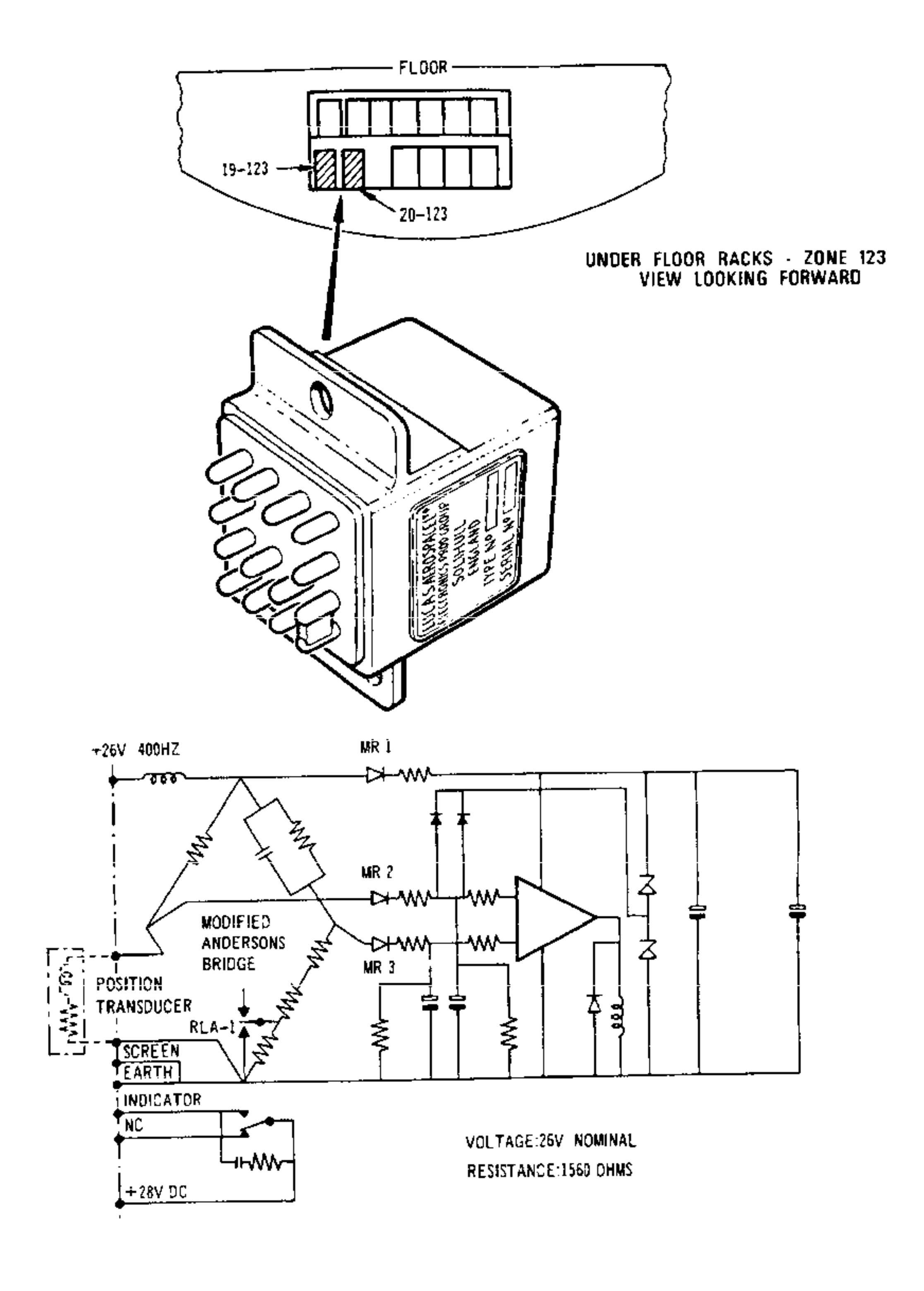






HP Shut-Off Valve Indication Details
Figure 003

CR 31996/00A



CMR 73 30 00 0 DAMO

Position Sensing Unit Details
Figure 004

The position sensing units are situated underfloor on rack 19-123 for engines 1 and 2 and on rack 20-123 for engines 3 and 4. Each unit is essentially a comparator consisting of discrete electronic components mounted on two wiring boards, a metal can, a header assembly, mouting flanges and a gasket.

Leads from the two printed wiring boards are connected to pins in the header assembly. The boards, components and leads are encapsulated in polyurethane foam and form an excapsulated module that is sealed in by soldering the header assembly to the can which in turn is evacuated and sealed. The gasket is located over the header pins and bonded to the header outer face. When a unit is plugged into its location, it is secured by means of nuts and washers assembled to three studs which align with the three holes in the mounting flanges.

D. Operation.

The inductive position transducer, mounted on the manifold dump valve of a distribution and dump valve, forms one arm of a modified Anderson's bridge. The manifold dump valve is hydraulically linked to the HP shut-off valve in the fuel flow control unit. In response to a HP shut-off valve position change, the manifold dump valve piston moves which causes the plunger to move in or out of the magnetic field of the position transducer. The system is so arranged that when the shut-off valve is closed the manifold dump valve is open and the transducer inductance is at a minimum value. Transducer inductance is at a maximum when the shut-off valve is open and the manifold dump valve is closed.

With the system switched ON and the transducer inductance at a minumum, the Anderson's bridge is unbalanced and the potential at MR2 is less than that at MR1. In this condition the output of the position sensing unit is low and the relay is not operated, this results in a SHUT display by the magnetic type indicator. When the transducer inductance is at a maximum the potential at MR2 exceeds that at MR1 and the output of the position sensing unit is sufficiently high to operate the relay. This changes the magnetic type indicator to display blank.

The changeover as the transducer passes through the calibration point at which the Anderson's bridge is at null is virtually instantaneous.

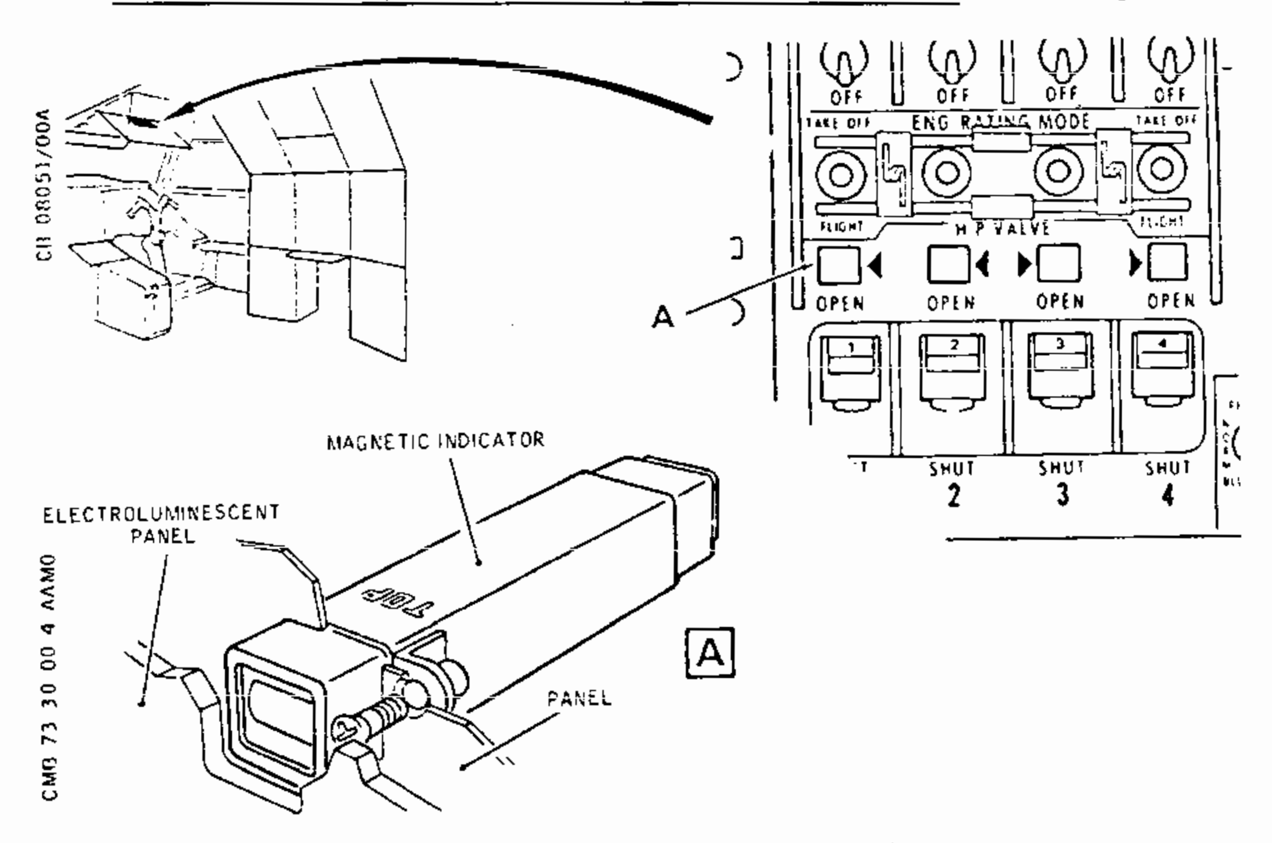
R INDICATING - REMOVAL/INSTALLATION

WARNING: COMPLY WITH THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

1. General

This topic contains instruction for the removal of minor electrical components fitted to panels and equipment racks that are common to 73-30-00. The components comprise amplifiers located in the underfloor equipment bay racking 19-123 and 20-123, and magnetic indicators (MIs) on panel 4-211.

2. Electrical Components Mounted on Panel 4-211(Ref. Fig. 401)



Electrical Components on Panel 4-211
Figure 401

R CAUTION: ELECTROLUMINESCENT (EL) PANELS ARE SUSCEPTIBLE TO
R SCRATCHES AND CRACKS. ENSURE THAT TOOLS DO NOT DAMAGE THE POLISHED WALLS OF THE PANELS.

CAUTION: WHEN INSTALLING ELECTRICAL COMPONENTS, THE TORQUE

LOADING OF TERMINAL SECURING DEVICES FOR CERTAIN COMPONENTS MUST BE CARRIED OUT IN ACCORDANCE WITH 20-27-14.

A. Prepare

(1) Isolate the electrical generation and external power in accordance with 24-00-00 Servicing.

(2) Remove the ganging bars and the rotary switch covers, loosen the screws and withdraw the electroluminescent panel (Ref. 33-16-00).

(3) Release the quick-release fasteners securing panel 4-211 and allow the panel to hinge down sufficiently for access to the HP shut-off valve MI.

(4) If necessary, release the cable loom ties for access to the terminals at the rear of the MI.

B. Remove Magnetic Indicator

(1) Withdraw the pin inserts from the rear of the indicator in accordance with the Wiring Diagram Manual 20-42-18.

(2) Remove the securing screws from the front of the panel and withdraw the MI from the rear.

C. Install Magnetic Indicator

(1) Comply with the electrical safety precautions.

(2) Assemble the magnetic indicator to the panel from the rear, ensuring that the word TOP on the body of the indicator is aligned with the white painted line at the back of the panel.

(3) Secure the indicator to the panel with the securing screws, from the front.

(4) Connect the electrical cables to the indicator terminals, ensuring that the connections are made in accordance with the cable identification and the applicable wiring diagram. Connect pin inserts in accordance with Wiring Diagram Manual 20-42-18.

(5) Secure cable loom ties, as necessary, in accordance with 20-27-15.

D. Conclusion

(1) Check that the area is clean, close the panel and secure it with the fasteners.

(2) Secure the electroluminescent panel (Ref. 33-16-00), replace the ganging bars and rotary switch covers.

(3) Make available electrical ground power (Ref. 24-41-00).

R (4) Test the HP shut-off valve indication (Ref.73-30-00,
R Adjustment/Test).

3. Electrical Components Mounted in Racking 19-123 and 20-123

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner	-

B. Prepare (Ref. Fig. 402)

(1) Isolate the electrical generation and external power in accordance with 24-00-00, Servicing.

(2) Open the service compartment door 123 BB (Ref. 52-41-11) to gain access to LH and RH engine relay boxes 19-123 and 20-123.

(3) Release the hold down fasteners from the appropriate engine or miscellaneous relay box hold down hooks.

(4) Withdraw the panel from the rack sufficiently to gain access to the cable clamps on the top of the box.

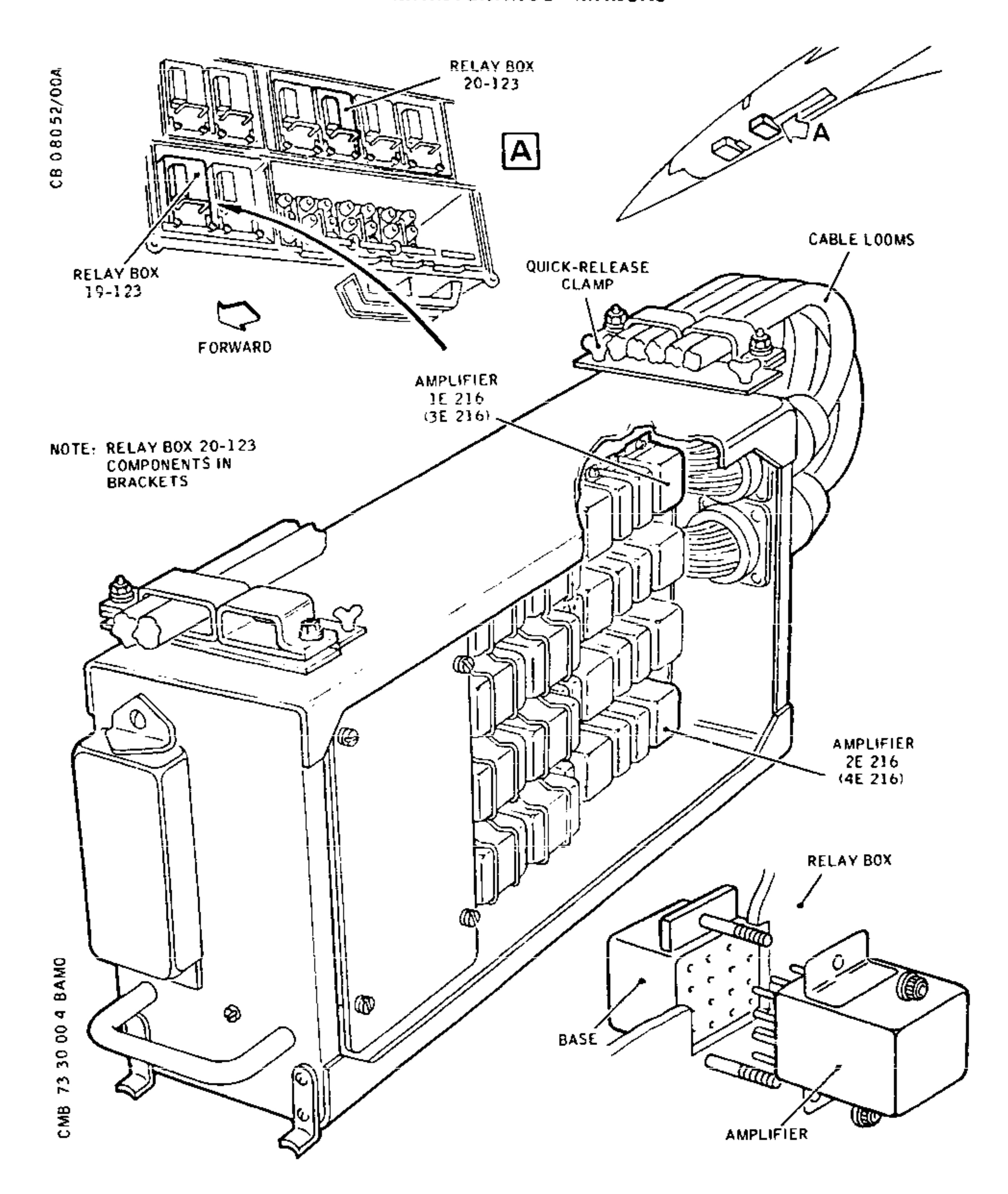
(5) Release the cable clamps to detach the cables from the top of the box.

(6) Move the box clear of the rack and lower it onto a suitable support.

C. Remove Amplifier

(1) Remove the nuts and washers securing the amplifier to its mounting base.

(2) Withdraw the amplifier from its socket.



Minor Electrical Components Racking 19-123, 20-123
Figure 402

D. Install Amplifier (Ref. Fig. 402).

(1) Comply with the electrical safety precautions.

(2) Check that the amplifier pins are clean and undamaged.

(3) Align the locating pin on the amplifier base with the locating hole in the amplifier mounting base and plug the amplifier into the base.

(4) Secure the amplifier with nuts and washers.

C. Conclusion

(1) Mount the relay box on the end of the rack support rails and secure the cables to the top of the panel with the quick release cable clamps.

(2) Slide the box into the racking and secure it with the hold down fasteners.

(3) Check that the relay box is bonded in accordance with 20-27-11.

(4) Cancel the electrical safety precautions and check the operation of the component by carrying out a check on the HP shut-off valve indication system.

(5) Check that the area is clean, close and lock service compartment door 123 BB (Ref. 52-42-11).

INDICATING - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General
This topic contains instructions for the operational testing of the HP value magnetic idnicator, after installation on roof panel 4-211.

2. Operational Test of HP Valve Magnetic Indicator

(1) Make available electrical ground power (Ref.24-41-00).

(2) With roof panel instrument lighting on, check that the HP Valve MI is illuminated.

(3) Trip the appropriate HP Valve position indication circuit breaker and check that the MI shows OPEN.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
ROOF PNL INST LTS SUP	L3-215	L379	F11
ENG 1 & 4 VALVE POS IND	15-216	E214	A10
ENG 2 & 3 VALVE POS IND	15-215	E213	B17

(4) Reset the circuit breaker and check that the MI shows SHUT.

FUEL DIFFERENTIAL PRESSURE WARNING SWITCH - REMOVAL/INSTALLATION

R 1. General

R Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

R 2. Tools and Equipment

Air bleed tube PE.22898

R Drain tube (Pre S.B. OL.593-73-1 drain valve)... PE.34076

R Drain tube (S.B. OL.593-73-1 drain valve) ... PE.26796

R Drain tube for heater and filter drain valve ... PE.21970

Circuit breaker safety clip ... ... -

R 3. Pressure Switch (Ref. Fig. 401)

A. Prepare to Remove Switch.

R (1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No. 1			
R	LP VALVE SUP 1	15-216	1Q1	C1
R	LP VALVE SUP 2	16-215	1Q2	-
R	FUEL HTR AUTO CONT	15-216	H1331	A11
R	FUEL HTR IND AND MANUAL CONT	5-213	H1333	B5
	Engine No. 2			
R	LP VALVE SUP 1	15-216	2Q1	F2
R	LP VALVE SUP 2	15-215	2Q2	C19
R	FUEL HTR AUTO CONT	15-215	H1332	E16
R	FUEL HTR IND AND MANUAL CONT	1-213	H1334	F8

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No. 3			
R	LP VALVE SUP 1	15-216	3Q1	F1
R	LP VALVE SUP 2	15-215	3Q2	C20
R	FUEL HTR AUTO CONT	15-215	H1332	E16
R	FUEL HTR IND AND MANUAL	1-213	H1334	F8
R	CONT			
	Engine No. 4			
R	LP VALVE SUP L	15-216	4Q1	C2
R	LP VALVE SUP 2	16-215	4Q2	-
R	FUEL HTR AUTO CONT	15-216	H1331	All
R	FUEL HTR IND AND MANUL	5-213	H1333	B5
R	CONT			

Circuit Breakers
Table 401

(4) Drain the engine fuel system.

R (a) Open bleed valve to expedite draining.
R
R (b) Use drain tube PE.34076 (Pre S.B. OL.593-73-1
R drain valve) or PE.26796 (S.B. OL.593-73-1
R drain valve) at the inlet elbow drain valve and
R drain tube PE.21970 at the fuel heater and
R filter drain valve. Direct free ends of drain
R tubes into a container and drain the system
R upstream of the FCU.

R (c) When fuel drain ceases, remove the drain tubes
R and close the bleed valve.

(5) Unscrew and remove fuel heater air duct spring housing assembly.

B. Remove Switch.

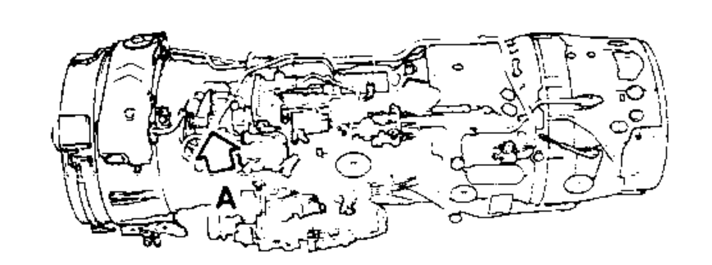
R (1) Disconnect electrical lead end plug from switch
R mounted at upper location of heater and filter unit.

(2) Support switch and remove attachment bolts.

(3) Remove switch from unit.

C. Install Switch.

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FUEL HEATER AND FILTER

SEAL PLATE

A

FIRST STAGE FUEL PUMP

CMR 73 31 01 4 AAM0

Switch and Attachment Details
Figure 401

R

R (1) Apply lubricant B to securing bolts.

R (2) Assemble a serviceable seal plate (Ref. 70-00-03,
R Sealing Devices) to pressure switch.

(3) With assembly pin engaged with hole, position switch and seal plate on upper location of heater and filter unit.

(4) Secure switch with five bolts torque-tightened to between 85 and 95 lbf in. (9,6 and 10,7 N.m).

R (5) Connect, tighten and wire-lock electrical lead end
R plug.

R D. Check for Leaks at Connections Disturbed During Procedure.

R (1) If a static pressure test for fuel leaks is to be
R carried out.

R (a) Use the aircraft fuel feed pumps or the pressure
R test and inhibiting rig (PTIR) as given in
R 73-31-01, Adjustment/Test.

R (b) On completion of static pressure test and
R removal of any installed test equipment,
R continue with the installation procedure of
R paragraph E.

R (2) If a leak check is to be carried out during an
R engine run, continue with the installation procedure
R of paragraph E.

R E. Complete the Installation.

R (1) Screw spring housing assembly onto fuel heater air
R duct end (Ref.71-00-02, Power Plant Build-Up Manual).

R (2) If a leak check is to be made during an engine run
R carry out a preliminary leak check using the aircraft
R fuel feed pumps.

R (a) Remove safety clips, reset circuit breakers
R (Ref.Table 401) and open the LP fuel isolation
R valve.

R (b) Install air bleed tube PE.22898, start
R appropriate aircraft fuel feed pumps and bleed
R all air from the system.

R (c) When fuel flows free of air, close the bleed

valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

(e) On completion of check, switch off the aircraft fuel feed pumps.

(3) To complete the installation or prepare for ground run, install the bleed and drain valve caps.

(a) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

(b) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

(4) Remove safety clips, reset circuit breakers (Ref. Table 401), and open the LP fuel isolation valve.

(5) If the fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing) that are required for the engine run checks, and comply with the procedures of 73-00-00 and 71-00-00, Adjustment/Test respectively. On completion of engine run, retrip circuit breakers and attach safety clips.

(6) Close engine bay doors (Ref.71-00-00, Servicing).

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FUEL DIFFERENTIAL PRESSURE WARNING SWITCH - ADJUSTMENT/TEST

1. Pressure Test and Leak Check the Switch

A. General.

This procedure is complementary to the Removal/Installation of the fuel differential pressure warning switch and gives the procedures for a static pressure test. The test is carried out using the test procedures, tools and equipment detailed for the reheat fuel flowmeter.

B. Carry Out Static Pressure Test

(1) To provide a more precise check for leaks, disconnect seal failure drains system tube union nuts from fluid passage bolt and connector at fuel heater and filter unit connection.

(2) Carry out a static pressure test and leak check with the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR) as detailed in 73-33-02, Adjustment/Test. Omit seal failure drains system tube detachment and leak check procedure at reheat fuel flowmeter drains connection and the reset procedure for the FUEL FLOW IND SUP circuit breaker.

(3) Check fuel heater and filter unit seal failure drains connection for signs of leaks. No leaks are acceptable. If a leak is disclosed, rectify defect (Ref.para.(4)).

(4) Procedure to locate and rectify a leak.

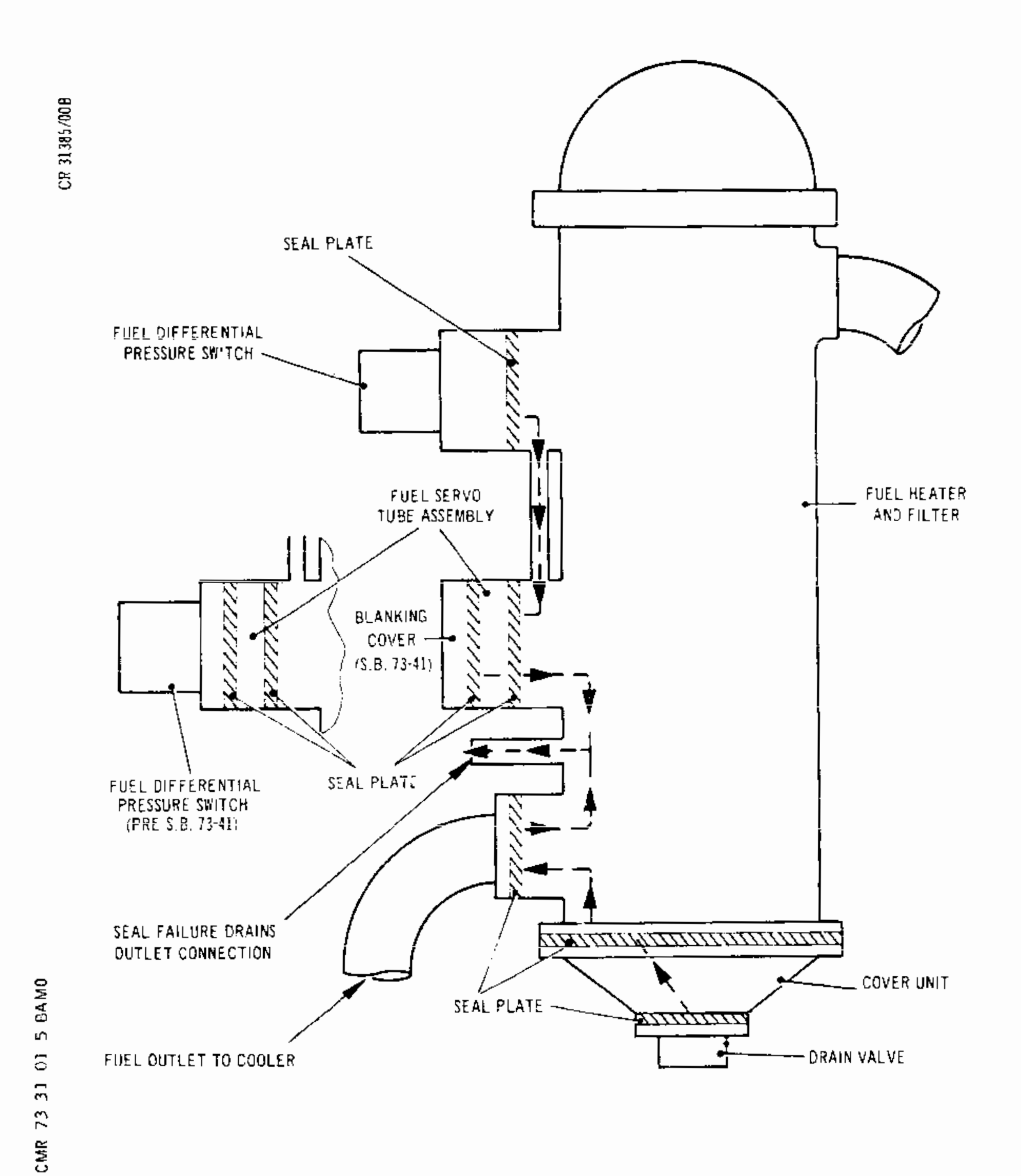
(a) The seal drains connection at the fuel heater and filter is interconnected internally to more than one seal. Establish the location of the defective seal(s) by reference to the illustration (Ref. Fig. 501).

(b) Renew a defective seal or component and then repeat the pressure test and leak check.

C. Complete the Procedure.

(1) Connect seal failure drains system at fuel heater and filter unit.

(a) Apply lubricant A to union connections.



Fuel Heater and Filter Seal Failure Drains
Transfer Passages and Outlets
Figure 501

R (b) Connect drains system tubes to fluid passage bolt and connector, triple torque-tighten thrust wire type union nuts (Ref.70-00-04, Torque Loading Data) to between 90 and 100 lbf in. (10,2 and 11,3 N.m).

R (c) Wire-lock both union nuts.

R (2) Complete the procedure as detailed in 73-31-01, Removal/Installation.

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FUEL ATOMIZING NOZZLE INLET THERMOMETER - REMOVAL/INSTALLATION

1. General

The fuel atomizing nozzle inlet thermometer is assembled to the rear face of the distribution and dump valve with its bulb projecting into the unit.

R The following procedures apply to both pre and S.B.OL.593-73-
R 8443-52 standard.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Circuit breaker safety clip ... ... -

3. Thermometer (Ref. Fig. 401)

A. Remove Thermometer.

(1) Open engine bay rear lower door (Ref.71-00-00, Servicing).

(2) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
TCA AND FUEL TEMP IND	4-213	1E52	E20
Engine No.2			
TCA AND FUEL TEMP IND	4-213	2E52	B20
Engine No.3			
TCA AND FUEL TEMP IND	4-213	3E52	B21
Engine No.4			
TCA AND FUEL TEMP IND	4-213	4E52	E21

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.

Circuit Breakers
Table 401

(3) Disconnect electrical lead end plug.

(4) Disengage locking wire from bolt at lower inner location, loosen attachment bolts and allow fuel to drain into a container.

NOTE: Discard drained fuel or inhibiting fluid.

(5) Remove bolts and withdraw thermometer.

B. Install Thermometer.

(1) Apply lubricant A to securing bolts.

(2) Assemble thermometer to distribution and dump valve with serviceable seal plate (Ref. 70-00-03, Sealing Devices).

(3) Secure thermometer with four bolts, locating the bolt for wire-locking at lower inner location.

(4) Torque-tighten bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(5) Connect, tighten and wire-lock electrical lead end plug.

C. Check for Leaks at Connections Disturbed During Procedure.

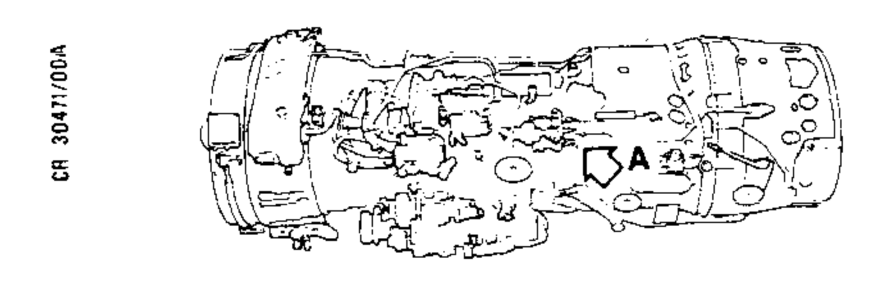
(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

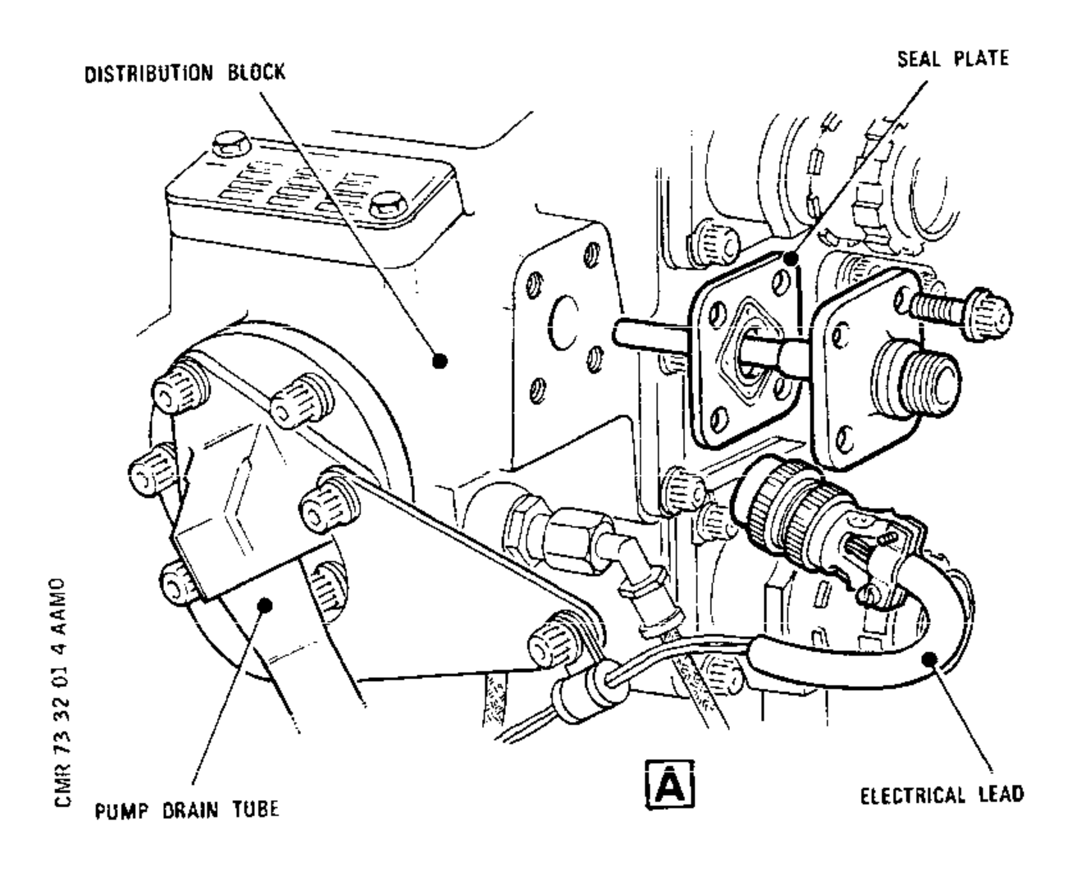
(a) Feed pumps pressure - comply with the procedures given in 73-32-01, Adjustment/Test, paragraph 2.

(b) PTIR pressure - comply with the procedures given in 73-32-01, Adjustment/Test, paragraph 3.

(c) On completion of static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph D.







Fuel Atomizing Nozzle Inlet Thermometer
Figure 401

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph D.

D. Restore Engine to Flight Standard.

(1) Remove safety clips and reset the circuit breakers (Ref. Table 401).

(2) If a leak check is to be made during an engine run, start appropriate aircraft fuel feed pumps and carry out a preliminary leak check at connections and the seal drains outlet at drains tank overflow vent. No leaks are acceptable. On completion of check, switch off the aircraft fuel feed pumps.

(3) Check that seal failure drains system tube union nuts at distribution and dump valve drains connection are wire-locked.

(4) If the fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref.71-00-00, Servicing) that are required for the engine run checks, and comply with the procedures of 73-00-00 and 71-00-00, Adjustment/ Test respectively. On completion of engine run, retrip circuit breakers and attach safety clips.

(5) Close engine bay doors (Ref.71-00-00, Servicing).

FUEL ATOMIZING NOZZLE INLET THERMOMETER - ADJUSTMENT/TEST

1. General

This chapter is complementary to the Removal/Installation of the thermometer and details the procedures for leak checks by application of a static pressure. Paragraph 2 details the leak checks using the aircraft fuel feed pumps and paragraph 3 details the leak checks using the pressure test and inhibiting rig (PTIR).

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Leak Check with Aircraft Fuel Feed Pumps

A. General.

The thermometer and associated connections are leak checked, using the appropriate aircraft fuel feed pump in conjunction with the procedures detailed in 73-00-00, Adjustment/Test.

B. Tools and Equipment.

R Pressure test equipment items (contained in adapter set PE.29964) are required as follows:

Blank	PE.35092
Blank/bleed valve	PE.35065
Blanking unit (2)	AS.15826

C. Prepare to Leak Check Thermometer and Associated Connections.

(1) Electrically isolate the T1 PROBE HEATER circuit breakers (Ref.Table 501) by tripping the breaker affecting the engine upon which work is to be carried out. Attach safety clips.

WARNING: WHENEVER ENGINE HP CONTROL CIRCUIT BREAKER IS TO BE TRIPPED OR HP VALVE SWITCH IS SET TO OPEN, FIRST TRIP ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER AND PREVENT UN-NECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMP-ERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.1			
T1 PROBE HTR SUP	13-215	1H542	C 9
Engine No.2			
T1 PROBE HTR SUP	14-215	2H542	E 8
Engine No. 3			
T1 PROBE HTR SUP	14-216	3H542	C14
Engine No.4			
T1 PROBE HTR SUP	13-216	4H542	C11

Circuit Breakers
Table 501

(2) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.B., as detailed for the installation and removal of the following items of test equipment and engine components respectively.

(a) AS.15826 - blanking unit (Ref. Fig. 501)(detail F). Install a blanking unit on each of the fuel atomizing pilot nozzle tube junction connections.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 502). Install items in outlet connections of distribution and dump valve.

(3) Direct free ends of drain tubes into a container.

(4) To provide a more precise check for fuel leaks, detach seal failure drains system tubes at distribution and dump valve (Ref. Fig. 502).

D. Leak Check Thermometer and Associated Connections.

(1) Pressurize and leak check the system.

(a) Remove the safety clips and reset circuit breakers (Ref. 73-32-01, Removal/Installation, Table 401).

(b) Ensure that all fuel connections are secure and start the appropriate aircraft fuel feed pumps.

(c) Select the HP VALVE switch OPEN and energize the start solenoid valve.

(d) Bleed air from the system by means of the bleed valve in the blank/bleed valve installed in the distribution and dump valve drain outlet.

(e) When system is free of air close valve and check system for signs of leakage. No leaks are acceptable.

(2) On completion of check, switch off pumps.

(a) Select HP VALVE switch to SHUT.

(b) Switch off the aircraft fuel feed pumps.

(3) If a seal failure drains connection leakage should occur:

(a) Establish the location of the defective seal by reference to paragraph 3.G.

(b) Renew a defective seal or component and then repeat the leak check.

E. Remove Pressure Test Equipment and Install/Connect Engine Components.

(1) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.D. as detailed for the removal and installation of the following items of test equipment and engine components respectively.

(a) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

R (2) Remove safety clip and reset circuit breaker (Ref.
R Table 501).

3. Leak Check Using PTIR

A. General

This paragraph details the procedure for a pressure test

and leak check using the PTIR and pressure test equipment On completion of the PTIR checks a final leak check is required using the aircraft fuel feed pumps to check remade connections after removal of test equipment.

B. Tools and Equipment.

Pressure test and inhibiting rig (PTIR)... ... PE.17988

Pressure test equipment items (contained in adapter set PE.29964) are required as follows:

Air bleed tube	PE.22898
Adapter (Pre.S.B.OL.593-73-1 drain valve)	PE.22972
Adapter (S.B.OL.593-73-1 drain valve) ...	PE.26710
Blank	PE.20757
Blank	PE.35092
Blank/bleed valve	PE.35065
Blanking unit (2)	AS.15826
Blanking plug	PE.29937
Clamp	PE.27277
Drain adapter	PE.20748
Drain adapter	PE.35666
Hose...	PE.22893
Hose...	PE.28394
Drain tube (Pre.S.B.OL.593-73-1 drain valve)	PE.34076
Drain tube (S.B.OL.593-73-1 drain valve)...	PE.26796
Circuit breaker safety clip	-

C. Test Fluid.

Aviation kerosine	D.Eng.R.D.2494
or	
Inhibiting fluid	DEF.2001A or D.Eng.R.D.2490

D. Drain the Inlet Section of the System.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Electrically isolate the engine additional services
R indicated in Table 502 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine No.1			
LP VALVE SUP 1	15-216	1Q1	C 1
LP VALVE SUP 2	16-215	1Q2	-
Engine No.2			
LP VALVE SUP 1	15-216	2Q1	F 2
LP VALVE SUP 2	15-215	2Q2	C19
Engine No.3			
LP VALVE SUP 1	15-216	3Q1	F 1
LP VALVE SUP 2	15-215	3Q2	C19
Engine No.4			
LP VALVE SUP 1	15-216	4Q1	C2
LP VALVE SUP 2	16-215	4Q2	-

Circuit Breakers
R Table 502

(3) Drain fuel from inlet elbow.

(a) Open bleed valve to expedite draining.

(b) Use drain tool PE.34076 (Pre.S.B.OL.593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve. Direct free end of drain tube into a container and drain the system upstream of the fuel heater and filter.

(c) When drain ceases, remove the drain tube and close the bleed valve.

NOTE: Discard drained fuel or inhibiting fluid.

E. Install Pressure Test Equipment.

(1) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.B., as detailed for the installation and removal of the following items of test equipment and engine components respectively.

(a) PE.20757 - blank and PE.27277 - clamp (Ref. Fig. 501) (detail A). Install in fuel inlet elbow.

(b) PE.22893 - hose and PE.22972 - adapter (Pre. SB.OL.593-73-1 drain valve) or PE.26710 adapter (S.B.OL. 593-73-1 drain valve)(Ref. Fig. 501) (detail A). Assemble hose and adapter to fuel inlet elbow drain valve location.

(c) PE.29937 - blanking plug (Ref. Fig. 501) (detail E). Install in the return fuel tube at outlet to ejector pump/first stage pump.

(d) PE.35666 - drain adapter (Ref. Fig. 501)(detail B). Install adapter in the throttle valve actuator gearbox spill/drain plug location.

(e) PE.20748 - drain adapter (Ref. Fig. 501)(detail A). Assemble drain adapter to fuel inlet elbow drain connection.

(f) AS.15826 - blanking unit (Ref. Fig. 501)(detail F). Install items on fuel atomizing pilot nozzle tube junction connections.

(g) PE.28394 - hose (Ref. Fig. 502). Connect to

CR 31229/00B

CLAMP

BLANK

FUEL INLET ELBOW

A

B

A

DRAIN VALVE

INLET ELBOW DRAIN
ADAPTER

ADAPTER
SB.73-1

COVER

HOSE ASSEMBLY

SEALING RING

ADAPTER
PRE SB.73-1

THROTTLE VALVE
ACTUATOR GEARBOX

DRAIN ADAPTER ASSEMBLY
(INCORPORATING RELIEF VALVE)

B

CMR 73 32 01 5 AAMA

Installation of Test Equipment and Location
(Sheet 1 of 2)
Figure 501

CR 31449/00C

EJECTOR PUMP OUTLET

BLANKING PLUG

FIRST STAGE PUMP

E

BLANKING PLUG

FUEL ATOMIZING PILOT NOZZLE TUBE JUNCTION

F

BLANKING PLUG

CMR 73 32 01 5 AAMB

Installation of Test Equipment and Location
(Sheet 2 of 2)
Figure 501

connection on servo fuel tube near connection to distribution and dump valve.

(h) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 502). Install items in fuel outlet connections of distribution and dump valve.

(2) Direct free ends of drain tubes into a container.

F. Pressure Test Procedure.

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple the two self-sealing hoses of the test rig to the installed test adapter hoses at the inlet elbow and the servo fuel tube.

(c) Verify that the weight of each hose is supported and that all connections are secure before commencing test procedure.

(d) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence the test procedure.

(2) Bleed all air from the system and continue with the low pressure test, paragraph (3).

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

(b) Install air bleed tube PE.22898, open the air bleed valve and allow to bleed until an air free fuel flow is obtained and then close the valve. Allow a short settling period and repeat the bleed process to ensure that the second stage pump region is air free and again close the valve and remove air bleed tube.

(c) Open bleed valve of manifold blank/bleed valve and allow to bleed until an air free flow is again obtained and then close bleed valve.

CR 31471/00B

COOLING FUEL TUBE

A

SERVO FUEL TUBE

DISTRIBUTION AND
DUMP VALVE

HOSE ASSEMBLY

BLANK

CMR 73 32 01 5 BAMO

A

BLANK/BLEED
VALVE

SEAL DRAINS TUBES

Distribution and Dump Valve - Installation of
Test Equipment and Seal Drains Location
Figure 502

(3) Carry out the low pressure test.

(a) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage, and ensure that the following conditions are met before commencing the high pressure test.

R (a1) No leakage from the primary static seals is acceptable. If a leak shows from the disconnected outlets of the seal failure drains system, find defective seal(s) by a process of elimination (Ref.para.G).

NOTE: A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

R (a2) There should be no spill from the actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

(4) Continue with a high pressure test.

(a) Operate the test rig and increase the test pressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check the disconnected seal failure drains connections for signs of leaks. No leaks are acceptable. If a leak is disclosed, find defective seal(s) by a process of elimination (Ref.para.G).

NOTE: The seal drains connection at the distribution and dump valve and fuel inlet elbow are inter-connected internally to more than one seal.

(d) If spill from actuator gearbox appears excesssive 100 cc/min. maximum acceptable limit) carry out an accurate leak rate check as specified in 73-00-00, Adjustment/Test.

(e) Reduce test pressure to zero and stop pump

motor.

(5) On completion of pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hoses. Open the bleed valves to expedite draining.

CAUTION: ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED. FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

G. Procedure to Locate and Rectify a Leak.

(1) Should a leak from a seal be disclosed, locate the defect and rectify it by renewal of seal plate or component. Refer to 73-11-01, Adjustment/Test to identify seals connected to fuel inlet elbow drains connection. The distribution and dump valve seal failure drains outlet connects internally to the following seals.

(a) FCU to distribution and dump valve rear face fuel servo spill tube seal.

(b) FCU to distribution and dump valve fuel servo tube seal.

(c) FCU fuel tube union to distribution and dump valve rear face fuel servo spill tube seal.

(d) Thermometer unit face seal.

(e) Upper fuel manifold connection to distribution and dump valve seal.

(f) Lower fuel manifold connection to distribution and dump valve seal.

(g) Engine fuel flowmeter fuel inlet connection seal.

(h) Engine fuel flowmeter fuel outlet connection seal.

(j) Starter pump to distribution and dump valve fuel tube seal.

(k) Distribution and dump valve to fuel atomizing pilot nozzle tube seal.

(l) Blanking plate seal.

(2) The following procedures will enable defective item to be identified.(Ref. Fig. 503).

(a) REmove each drain duct cover plate, in turn, and determine (with test pressure applied) from which individual ports the fuel leakage occurs. Install the cover after each check. Establish the location of the defective seal by reference to the illustration.

(b) Release test pressure.

(c) Renew a defective seal or component and then repeat the pressure test and leak check.

H. Remove Test Equipment and Install/Connect Engine Components.

(1) Carry out the procedures of 73-00-00, ADjustment/Test, paragraph 6.D., as detailed for the removal and installation of the following items of test equipment and engine components respectively.

NOTE: If an engine is to be inhibited, refer to 70-00-07, Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(a) PE.20757 - blank and PE.27277 - clamp ring Remove blank and clamp ring and reconnect the aircraft/engine main fuel connection.

(b) PE.22893 - hose and PE.22972 - adapter (Pre. S.B. OL.593-73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve). Remove hose and adapter and install drain valve.

(c) PE.29937 - blaning plug. Remove plug and install blanking ferrule at ejector pump.

(d) PE.35666 - drain adapter. Remove adapter and install the blanking plug in the actuator gearbox.

R (e) AS.15826 - blanking units. Remove blanks and
R connect fuel atomizing pilot nozzle tubes to the

CR 31386/00B

1. FCU TO DISTRIBUTION AND DUMP VALVE SERVO FUEL TUBE SEAL

2. STARTING PUMP TO DISTRIBUTION AND DUMP VALVE FUEL TUBE SEAL

3. DISTRIBUTION AND DUMP VALVE TO FUEL ATOMIZING PILOT NOZZLE JUNCTION FUEL TUBE SEAL

ENGINE FUEL FLOWMETER CONNECTION SEALS

BLANKING PLATE

CMR 73 32 01 5 CAMO

UPPER FUEL MANIFOLD CONNECTION TO DISTRIBUTION AND DUMP VALVE SEAL

LOWER FUEL MANIFOLD CONNECTION TO DISTRIBUTION AND DUMP VALVE SEAL

TWO SERVO SPILL TUBE SEAL CONNECTIONS AT DISTRIBUTION AND DUMP VALVE REAR FACE

BLANKING PLATE SEAL

THERMOMETER UNIT FACE SEAL

COMMON OUTLET TO DRAIN CONNECTION

Distribution and Dump Valve Seal Failure
Drains Transfer Passages and Outlets
Figure 503

tube junction.

(f) PE.28394 - hose. Detach hose adapter and install blanking ferrule to connection on servo fuel tube.

(g) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

(2) Carry out a final leak check.

(a) Remove safety clips and reset circuit breakers
R (Ref. Table 502).

(b) Ensure that all fuel connections are secure, open the LP fuel valve and start the appropriate aircraft fuel feed pumps.

(c) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valves, blanking ferrules and the drains outlets of the aircraft/engine connections under test. No leaks are acceptable.

NOTE: The manifold flight standard blanking ferrules cannot be leak checked using aircraft feed pump pressure.

(e) On completion of check, switch off the aircraft feed pumps.

(3) PE.20748 - drain adapter. Remove drain adapter from inlet elbow and connect the seal drains system as detailed in 73-00-00, Adjustment/Test, paragraph 6.D.

(4) Ensure that seal is in place and assemble the dust cap to the air bleed valve. Tighten the cap and wire-lock it.

(5) Assemble pressure cap with new seal to the fuel inlet elbow drain valve. Tighten the cap and wire-lock

it.

(6) Complete the procedure as detailed in 73-32-01, Removal/Installation.

TCA TEMPERATURE, FUEL TEMPERATURE INDICATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The four dual indicators, TCA and fuel temperature, are mounted on panel 4-214 at the 3rd crew member's (3CM) station. As the indicators are identical, the removal/installation procedure detailed for one indicator is applicable to all four, the reference to No.1, 2, 3 or 4 being for the indicator in a particular engine (No.1, 2, 3 or 4) system.

2. TCA Temperature, Fuel Temperature Indicator

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare to Remove

(1) Electrically isolate the indicator to be removed by tripping the appropriate circuit breakers, including the instrument lighting and lights test circuit breakers.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 TCA & FUEL TEMP IND	4-213	1E52	E20
ENG 2 TCA & FUEL TEMP IND	4-213	2E52	B20
ENG 3 TCA & FUEL TEMP IND	4-213	3E52	B21
ENG 4 TCA & FUEL TEMP IND	4-213	4E52	E21
3CM STN INST LTS SUP	13-216	L377	E7

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
3CM STN LH LT TEST SUP 2	15-216	L1004	C13

C. Remove

NOTE: The panel-mounted indicator electrical connector is spring-loaded, exerting an initial forward pressure of approximately 10 lbf (4.54 kgf) on the indicator.

(1) Hold the face of the indicator firmly toward the instrument panel.

(2) Loosen the adapter plate securing screws; then, with the indicator still held firmly toward the panel, remove the screws and adapter plate.

(3) Gradually release the pressure on the indicator, which will be forced approximately 0.5 in (12 mm) out of the panel aperture by spring pressure.

(4) Carefully withdraw the indicator from the panel.

NOTE: The indicator must be supported as it is withdrawn from the panel, to allow for the extra weight when the electrical connector and locating spigot are disengaged.

D. Prepare to Install

(1) Check that the instrument electrical connector is clean and undamaged.

E. Install

(1) Comply with the electrical safety precautions.

(2) Position the indicator in the panel aperture.

(3) Align the instrument case horizontally and engage the locating spigot.

(4) Position the adapter plate on the indicator face; gently but firmly engage the electrical connector and press the indicator fully into engagement.

(5) Maintain the pressure on the indicator and secure the adapter plate with the screws.

F. Conclusion

(1) Remove the safety clips and reset the circuit breakers
R tripped before indicator removal, ensure CB's relevant
R to the indicators not being tested are tripped.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Check the indicator integral lighting (Ref. 33-17-00) and the warning lamp filaments (Ref. 33-14-00).

(4) Check the operation of the FUEL TEMP indicator bezel-mounted warning light (Ref. 73-30-00); check that
R the indicator reads ambient temperature. Where necessary
R repeat test for other engine indicators with only the
R appropriate CB's reset, if necessary perform a comparison
check with another indicator at the next engine run.

(5) Perform the appropriate sections of the Operational and Functional Tests detailed in 77-22-00, Adjustment/Test, to check the TCA indicator.

(6) Switch off and disconnect electrical ground power.

R (7) Ensure all relevant CB's are reset.

END OF THIS SECTION

NEXT

FUEL FLOW INDICATION - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001, 002 and 003)

The fuel flow indication system measures and indicates the fuel consumed by each engine, the fuel flow rate of each engine, and the total fuel remaining and aircraft weight.

Each engine system contains a main fuel flowmeter transmitter, reheat fuel flowmeter transmitter, a fuel consumed indicator and a fuel flow rate indicator. The transmitters are engine-mounted whilst the fuel consumed indicators and flow rate indicators are mounted on panel 5-214 (fuel management panel) and 6-211 (centre instrument panel) respectively.

A single indicator, total fuel remaining, also mounted on panel 5-214, receives signals from each fuel consumed indicator and gives a continuous reading of the total fuel remaining and aircraft weight on two separate digital displays.

A setting index on each flow rate indicator provides a switch output to the configuration warning system (Ref. 77-13-00) and a potentiometer in the indicator gives an output to the flight data recorder (Ref. 31-31-00). The system also supplies signals for the reheat control amplifier (Ref. 76-00-00).

A dimming facility is provided for the digital displays on the fuel consumed and total fuel remaining indicators, controlled by a potentiometer on panel 11-214.

An electronic unit, located on shelf 1-216 in the flight compartment, provides some of the a.c. and stabilized d.c. power supplies to the indicators; it also provides equipment for a built-in test facility (BITE).

2. Fuel Consumed Indicators (Ref. Fig.001 and 003)

The fuel consumed by each engine (main), or main plus reheat, is indicated by a four-digit display in kg x 10.

A reset knob is provided on each indicator; the knob also enables the transmitters to be functionally tested, without resetting the display. Two yellow warning lamps (M and R/H), mounted on the indicator, are lit if a density correction system servo loop associated with either a main or reheat flowmeter transmitter fails to balance, or when the density correction system is tested.

The indicator is integrally lit and a warning lamp filament test facility is provided (Ref. 33-17-00 and 33-14-00).

3. Flow Rate Indicators (Ref. Fig.001 and 003)

The fuel flow rate indicators are servo-operated instruments which display information by a counter and pointer presentation in response to input signals from the main and reheat flowmeter transmitters. The indicators comprise an electronic section consisting of six plug-in modules and a motor generator which drives, by means of a gear train, a potentiometer and display mechanism.

The indicator is contained in a 2ATI case which carries, at the rear, a multi-way electrical connector.

Electrical supplies are obtained from a power supply (electronic unit) which is powered from the aircraft power supply.

The presentation consists of a pointer moving over a dial, calibrated from 0 to 35 kg/h x 1000 in 5 kg/h x 1000 increments, and a three-drum counter giving a full digital readout. A striped warning flag appears in front of the counter if the power supply fails or if a failure occurs in the servo-system. A mode flag appears on the dial to indicate whether main flow (FE) or main flow plus reheat (FT) is being displayed.

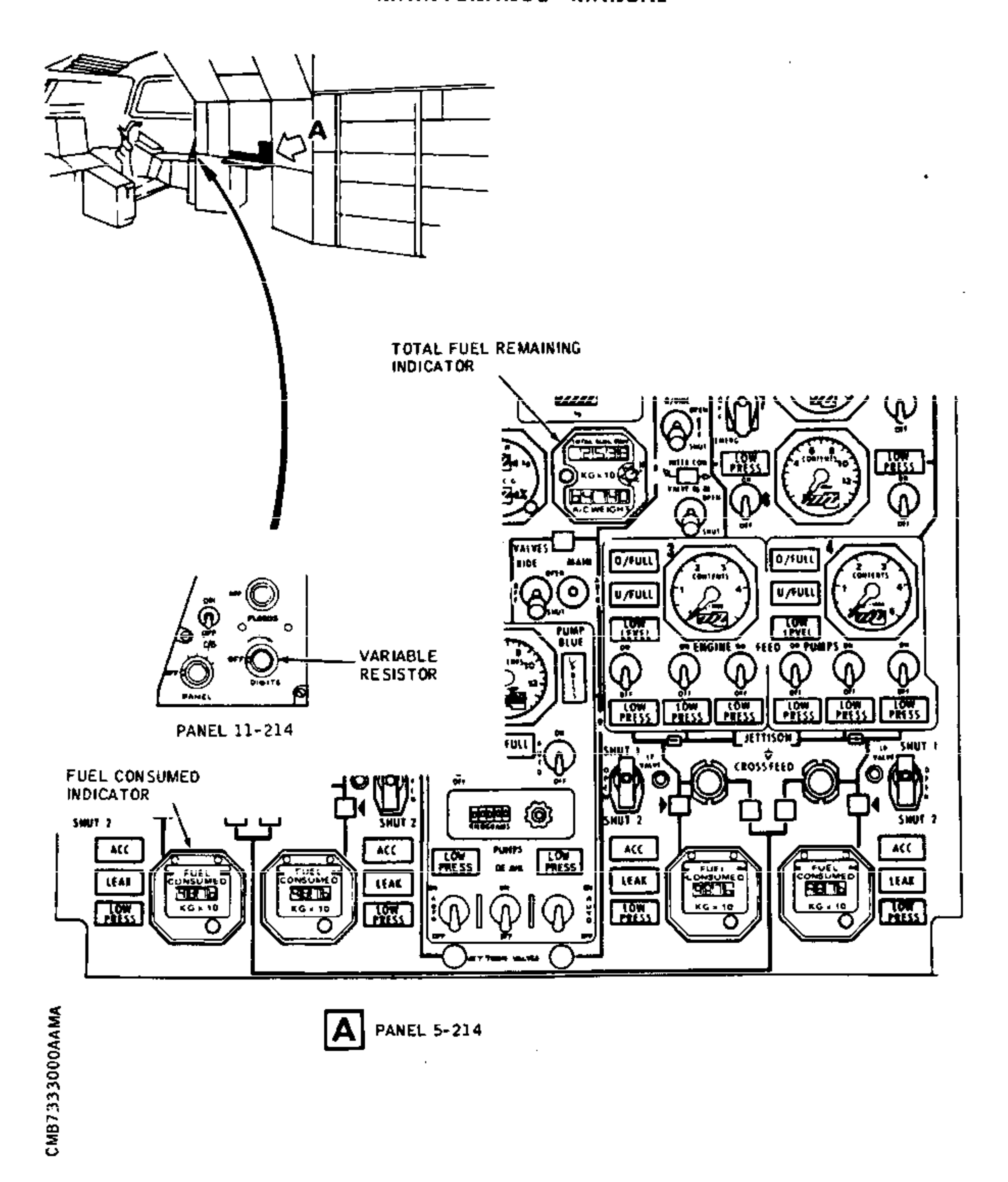
An index mark on the dial scale is adjusted by a rotatable knob on the front of the indicator; the knob also actuates a three-drum counter which repeats the index setting. The index provides a switch output to the configuration warning system (Ref. 77-13-00).

A signal, proportional to main plus reheat fuel flow (FT) is available for the flight data recorder (Ref. 31-31-00).

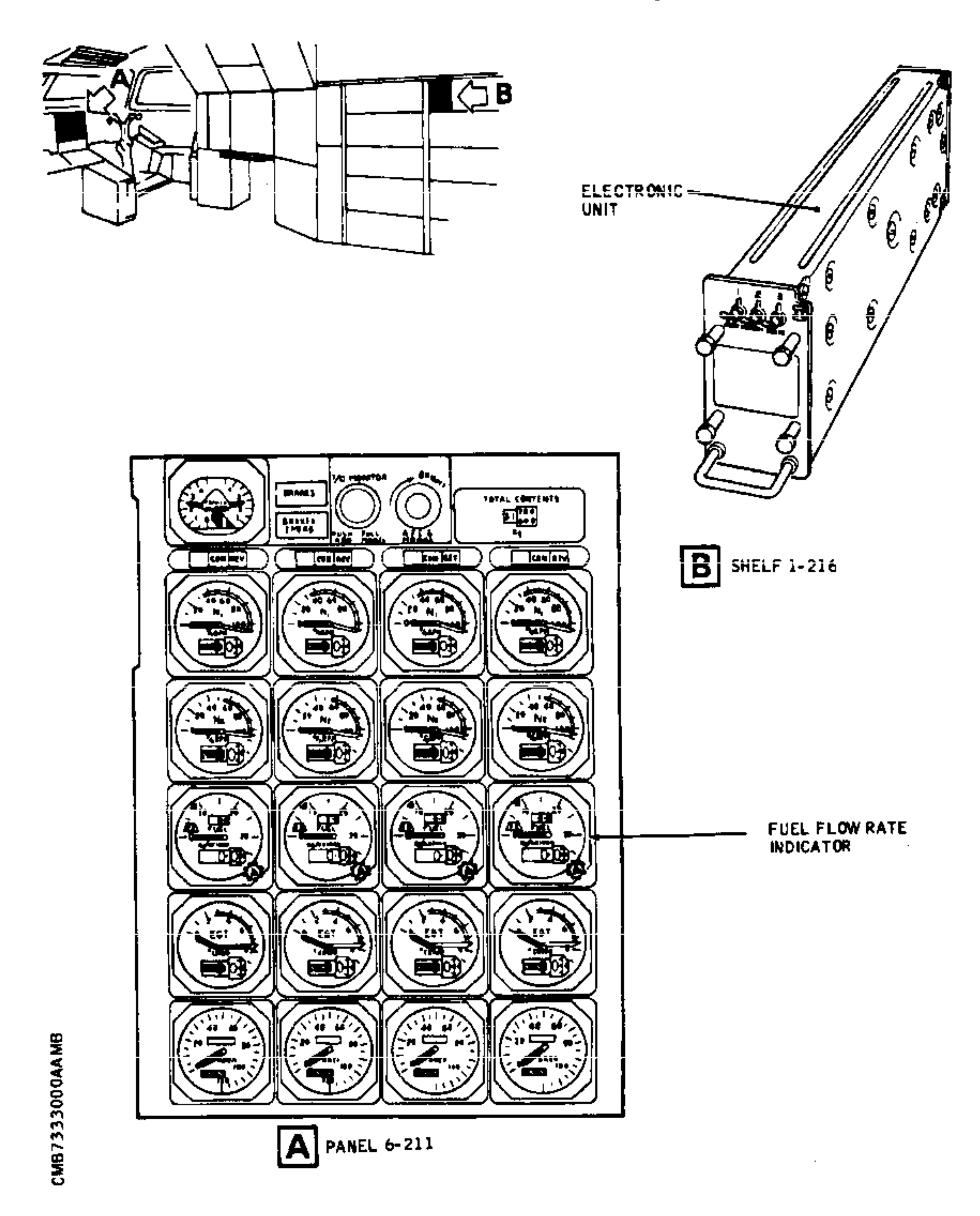
The dial presentation is electrically lit from a 5 V d.c. supply (Ref. 33-17-00).

4. Total Fuel Remaining Indicator (Ref. Fig.001 and 003)

The total fuel remaining indicator receives and processes information regarding the fuel consumed from the four associated fuel consumed indicators, to provide an indication of the total fuel remaining, on a four-digit display (kg x 10), and the aircraft weight on a five-digit display (kg x 10).



- Fuel Flow Controls and Indicators (Sheet 1 of 2)
Figure 001



- Fuel Flow Controls and Indicators (Sheet 2 of 2)
Figure 001

The indicator comprises two numeric electrical displays and an electronic assembly, housed in a 2ATI clamp-mounted case.

The two digital displays consist of seven-bar tungsten filament lamps. The electronic assembly is contained in a rectangular compartment containing a number of plug-in printed circuit boards, associated connectors and wiring. In addition there are two reset knobs and their associated switches.

All the electrical connections to the indicator are made by a multi-pin connector mounted on the backplate. The backplate also carries a metal dowel to locate and support the rear of the indicator when the unit is installed in the aircraft. The main electrical supplies are obtained from the electronic unit.

The dial presentation is electrically lit from a 5 V d.c. supply (Ref. 33-17-00).

5. Electronic Unit (Ref. Fig.001 and 003)

The electronic unit provides power for the logic circuits, memory circuits and the seven-bar display filaments of the fuel consumed and total fuel remaining indicators.

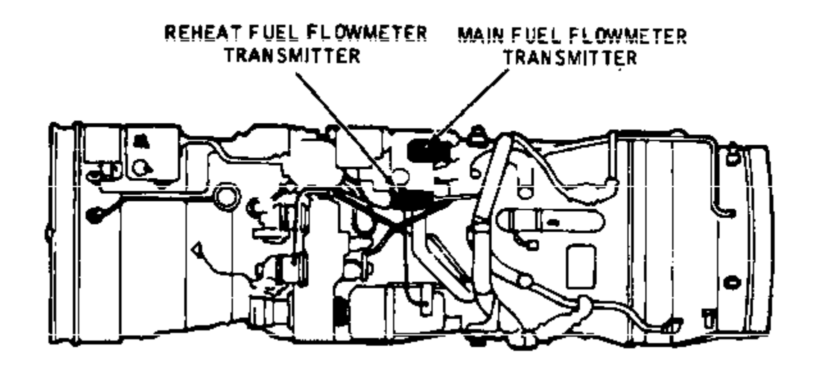
The unit also provides a dimming signal, controlled by a potentiometer located on panel 11-214, and a centre bar brighten-up signal for the digital displays for the fuel consumed and total fuel remaining indicators. Some of the built-in test equipment (BITE) for the system is contained in the unit. The BITE facility is operated by three switches (COUNT, MEMORY and SERVO) mounted on the front panel; the switches are also numbered 1, 2 and 3 respectively.

Electrical connections to the unit are made by a multi-pin connector. The unit is secured in the aircraft by four captive screws at the front and a spigot at the rear of the case, to provide a positive means of location.

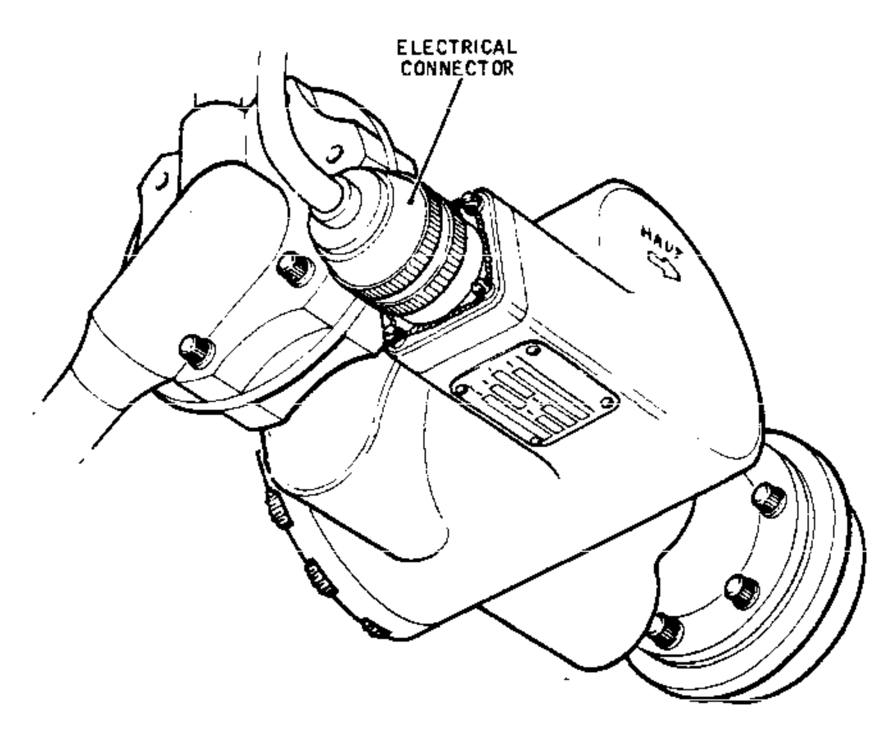
6. Flowmeter Transmitters (Ref. Fig.002 and 003)

Two transmitters are installed on each engine, a main transmitter and reheat transmitter; each provides an output in the form of electrical pulses, the frequency of which is proportional to mass flow. The transmitters comprise the following mechanisms housed within a case:-

(1) A measuring unit consisting of a free-running helical rotor, two magnetic pick-up coils and a movable



INVERTED PLAN VIEW OF ENGINE



FUEL FLOWMETER TRANSMITTER (TYPICAL)

CMB7333000BAM0

- Location of Fuel Flowmeter Transmitters
Figure 002

nozzle.

(2) A servo mechanism comprising a two-phase servo motor, a pinion transmission which engages with the movable nozzle, and a linear differential transformer to register the nozzle position.

(3) A densitometer consisting of floats which operate a second linear differential transformer to convert variations of fuel density into electrical signals.

The four-bladed rotor, supported by bearings at each end of its shaft, is located with its axis in line with the fuel flow. A magnet is embedded in one blade of the rotor and passes close to the magnetic pick-up coils which output one pulse for each pass. Movement of the densitometer floats is transmitted, by a sector and toothrack, to the core of the associated differential transformer. The secondary winding of this transformer is wired in opposition to that of the transformer associated with the servo motor, so that any difference in the relative core positions will cause a voltage output to be fed to a servo-amplifier contained in an associated fuel consumed indicator.

An output from the servo-amplifier is fed to the control windings of the transmitter servo motor which operates, by a pinion and toothrack, to move the conical nozzle axially in relation to the rotor. The servo motor also repositions the core of its associated differential transformer, by a lead screw, to nullify the servo loop.

Electrical connections to the unit are made by a 10-pin plug mounted on the unit body. The electrical power supplies are obtained from the aircraft 115 V a.c. supply and from a power pack in the associated fuel consumed indicator.

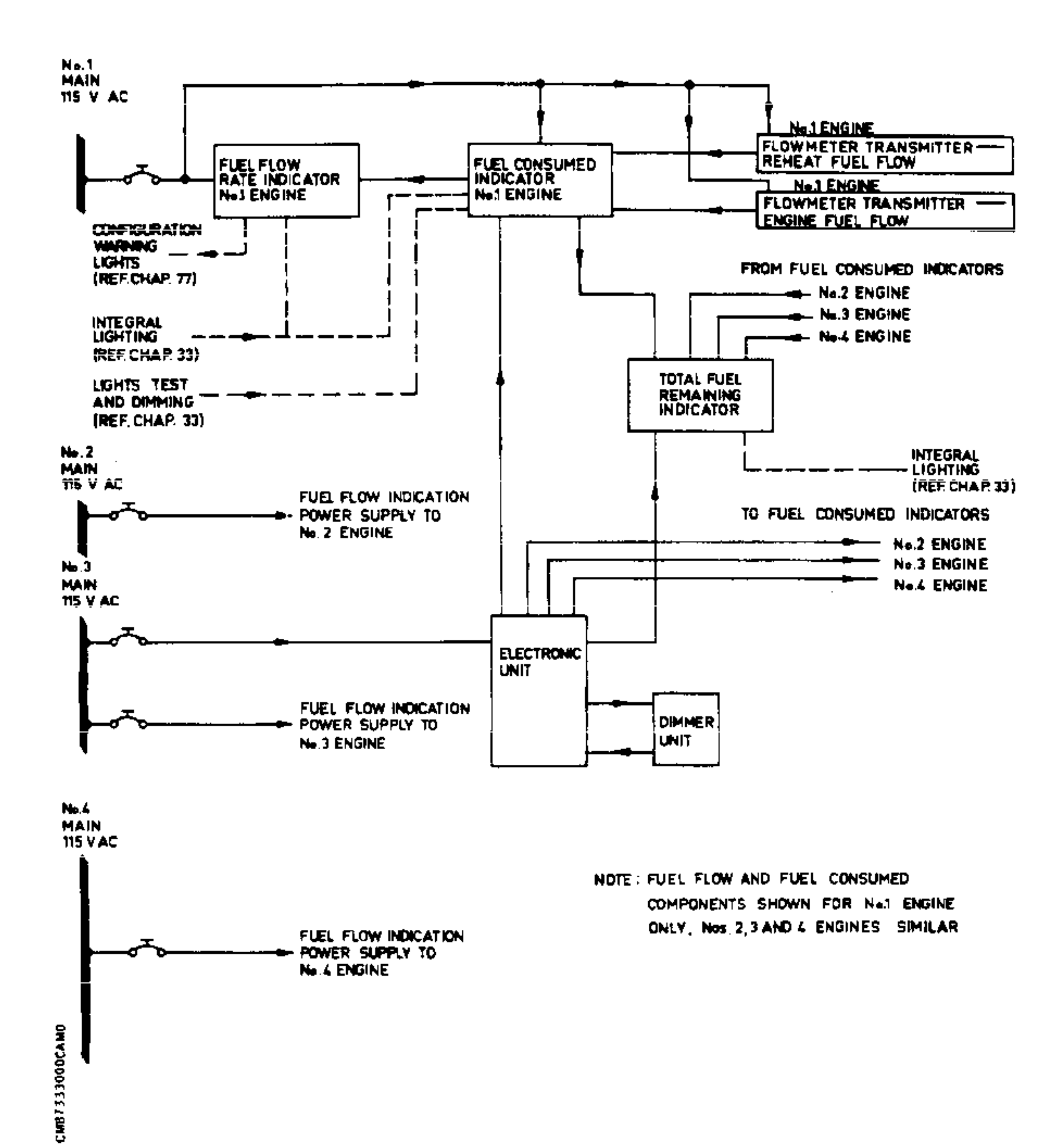
Flanges, situated at the inlet and outlet ports, provide a means of mounting the unit in the fuel supply pipeline. The flanges are of different size with asymmetric mounting holes to prevent incorrect installation.

7. Operation (Ref. Fig. 001, 002 and 003)

A. Functional Description

(1) Flowmeter Transmitters

When fuel flows through the transmitter, the rotor rotates at a speed proportional to fuel mass flow and the magnet induces a current in the pick-up coils. The coils provide an output in the form of



Fuel Flow Indication - Block Diagram
Figure 003

electrical pulses (32 pulses/kg of fuel) which is fed to the associated fuel consumed indicator and to the reheat amplifier (Ref. Chap.76).

Compensation for changes in the fuel density is effected by the conical nozzle. The venturi action of the nozzle produces an increase in fuel flow velocity in the region of the spinner. The position of the nozzle, relative to the spinner, determines the speed at which the rotor rotates for a given mass of fuel. The nozzle position is adjusted by the servo motor which reacts to an output from the densitometer by way of the servo-amplifier. Therefore, the number of revolutions of the spinner, for a given mass of fuel, remains constant throughout the specific density range.

(2) Fuel Consumed Indication

Pulse inputs (32 pulses/kg), basically sinusoidal, from the associated transmitters are fed to squaring amplifiers and pulse shaping networks within the fuel consumed indicator. They are also routed to the associated fuel flow rate indicator. The outputs from the shaping networks are in the form of squared pulses representing main and reheat fuel flow. These pulses are summed and fed to a frequency dividing network to give an output of 1 pulse/10 kg.

The output from the frequency divider is fed to the first of four cascaded decade counters to drive the 7-bar digits via decoder/driver circuits.

The frequency divider output is also fed, via a line driver, to the total fuel remaining indicator.

Memory circuits are incorporated in the indicator to provide data recovery following power supply interruptions. A voltage level detector unit is triggered when the main +5 V power supply to the system falls below a predetermined level. This causes a memory drive circuit to feed a 'write' pulse to magnetic core stores. This pulse induces a current in the magnetic core stores which instantaneously assume a magnetic state equivalent to the binary coded decimal (BCD) logic level output of the decade counters. This magnetic state is maintained until the power supply recovers to a predetermined level at which instant a memory drive circuit supplies a 'read' pulse to the

magnetic cores.

The 'read' pulse reverses the magnetic state of the cores and induces a voltage pulse into the core 'sense' windings. Simultaneously, a 'load' pulse is fed to the 'load' input of the decade counters, allowing the information to be transferred from the magnetic cores into the counters.

If the power failure is of short duration (typically less than 250 ms) the data is fed to the displays upon restoration of power. In the event of longer term interruptions, circuitry within the system electronic unit inhibits the display and, upon restoration of power, data is transferred from the magnetic cores to the count circuits only. Counting will continue but the displays will show only the centre bar on each digit to signify that the power supply interruption was of sufficient duration to cause an error in the indication. The count is transferred to the display by pressing and releasing the left reset knob, situated on the total fuel remaining indicator, with the right knob in the N position.

The display is reset to blanks, except the least significant digit which reads zero, by pulling and turning the reset knob on the fuel consumed indicator in a counter-clockwise direction.

Clockwise rotation of the reset knob performs two of the system integrity test functions:

(a) It checks the integrity of the display by driving all the digits to figure eight and,

(b) at the same time, it checks the operation of the density correction system in the associated main and reheat transmitters. The main 'M' and reheat 'R/H' warning lights on the indicator will light and then go out if the system is functioning correctly.

The filaments of the warning lights and associated circuitry can be checked by the lights test facility (Ref. 33-14-00).

The seven-bar digital display may be dimmed by means of a remote potentiometer which controls a

pulse-width modulator within the electronic unit. Operation of the potentiometer varies the mark space ratio of a digital blanking signal and thus varies the intensity of illumination.

(3) Flow Rate Indication

Two outputs from the main flow and reheat transmitters are processed to produce a d.c. voltage proportional to the sum of the two input frequencies. The difference between this voltage and the output voltage of the indicator potentiometer is inverted and the resulting a.c. signal is amplified and used to energize and control the winding of the indicator motor generator. The motor shaft drives the potentiometer to null and drives the display mechanism to the new reading. The generator output is fed to the amplifier to increase the stability of the indicator.

The mode flag changes from FE to FT when the fuel flow rate of the reheat reaches a specific value.

An integral differential switch compares the index setting and pointer indication and, when the difference in these readings changes sign, the switch actuates an integral relay. The contacts of this relay are connected to the aircraft configuration warning system (Ref. 77-13-00).

If the fuel flow indication is at zero and the index is set to approximately full scale, the relay is actuated; this provides a test facility of the index switch.

(4) Total Fuel Remaining Indication

Electrical signals in the form of squared pulses, representing fuel consumed, are received from the four associated fuel consumed indicators. The signals are fed via line receivers to an input gating network. The resultant signals, proportional to the sum of the fuel consumed by the four engines, are fed to inputs of two sets of cascaded decade counters.

The outputs from the decade counters are used to operate the digital displays by way of decoder/ drive circuits.

The outputs from the driver circuits are subtracted

from the preset figures on the display to give continuous readings of the total fuel remaining and aircraft weight.

As with the fuel consumed indicators described in paragraph A.(2), above, memory circuits are incorporated in the indicator to provide data recovery following power failure interruptions. If the power failure is of short duration, the data is fed to the displays upon restoration of power. In the event of longer term interruptions, the displays are inhibited and upon restoration of power, data is transferred from the magnetic core to the count circuits only. Counting will continue but the displays will show only the centre bar on each digit to signify that the power supply interruption was of sufficient duration to cause an error in the indication. The count can be transferred to the display by pressing and releasing the left reset knob, with the right reset knob set to N.

The left reset knob performs two functions. When the knob is pressed and held (with the right knob set to N) the integrity of the displays in the total fuel remaining indicator is checked by all digits being driven to show the figure eight. During this time the count circuits continue operating and when the knob is released the count will be transferred to the displays.

The operation of the left reset knob will also restore the supplies to the fuel consumed indicators.

The right reset knob controls a six-position switch and is set to N for normal use.

The other five switch positions are used in setting the aircraft weight and total fuel remaining figures into the displays, in conjunction with the left reset knob.

Each position of the right reset knob corresponds to a digit, reading in a counter-clockwise direction from N, 1 to 4 for the total fuel remaining and 1 to 5 for the aircraft weight. If the left reset knob is pressed and released with the right knob in the first position, the least significant digits increase by one. The digits are raised one by each action until the required figure is achieved with

the right knob in all positions in turn.

The total fuel remaining display can be set to zero (after setting the aircraft weight) by turning the right reset knob to the first position past N (in a counter-clockwise direction) and pulling and releasing the left reset knob. To set the required total fuel remaining display, the setting procedure is repeated as described above. During the setting of the total fuel remaining display, the fuel load is automatically added to the aircraft weight.

The seven-bar digital display is dimmed by the same potentiometer which is used to dim the fuel consumed indicator display.

(5) Electronic Unit

The 115 V 400 Hz aircraft supply passes via a RF filter network to the primary of a toroidal transformer. The transformer has four secondary windings, the first of which supplies an output to two full-wave rectifier circuits. The outputs from the rectifiers are smoothed by L/C and R/C filter networks and fed to a voltage rectifier which supplies a stabilized +5 V output to logic circuits in the fuel consumed and total fuel remaining indicators. This supply is also used, in conjunction with a -5 V supply, to operate a 133 Hz phase-shift test oscillator within the unit. The output from the oscillator is used during operation of the BITE count test.

The output from the second winding of the transformer is fed via rectifier and regulator circuits and provides a stabilized -5 V supply to the logic circuits in the fuel consumed and total fuel remaining indicators. The output from the third winding is rectified and provides an unsmoothed 5 V d.c. supply to the seven-bar digits in the fuel consumed and total fuel remaining indicators. The a.c. output from this winding is also used to operate a pulse-width modulator which supplies a signal to control the brightness of the indicator digits via a remote dimmer unit (variable resistor).

The output from the fourth winding is also rectified and smoothed and provides a 25 V d.c. supply to the memory circuits of the fuel consumed and total fuel remaining indicators. The 25 V d.c. supply is also

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used to operate relays in the fuel consumed indicator during the count and servo BITE tests and is fed to the transmitter transformer primaries for the integrity test.

The unit also supplies a signal to light the centre bars only of each digit in the fuel consumed and total fuel remaining indicators when power supplies are restored following an interruption of more than 250 ms. This indicates that sufficient time has elapsed to cause an error in the reading.

Restoration of the reading is effected by operation of the reset knobs on the total fuel remaining indicator.

The BITE facilities are controlled by three switches on the front of the unit marked COUNT 1, MEMORY 2 and SERVO 3.

Operation of the switch marked COUNT 1 causes the output from the 133 Hz oscillator to be fed to the signal amplifiers in the fuel consumed and fuel flow rate indicators, in place of the input from the main and reheat fuel flowmeter transmitters. The fuel flow rate indicators will display a reading of approximately 30,000 kg/h, and the fuel consumed indicators count up for as long as the switch is operated.

The readings of the total fuel remaining and aircraft weight will decrease by the sum of the changes in the fuel consumed indicators. Upon release of the switch, the fuel flow rate indicators return to zero and the fuel consumed, total fuel remaining and aircraft weight indications will remain at their end-of-test readings.

Operation of the switch marked MEMORY 2 interrupts the 115 V 400 Hz supply to the primary transformer within the unit, for as long as the switch is operated. This causes interruption in the supplies to the counting circuits in the fuel consumed and total fuel remaining indicators and the data held by the counters is transferred to the magnetic core stores. When the switch is released the data is fed back into the respective decade counters.

If the switch is operated for a period exceeding 250 ms, the centre bar only of each digit is lit. The count circuits continue to operate but

the count will not be displayed until the reset switch, actuated by the reset knob on the total fuel remaining indicator, is operated.

Operation of the third switch, marked SERVO 3, causes a 400 Hz signal to be applied to the input of both servo amplifiers in each of the
R fuel consumed indicators. Power is applied to the servo motors in the main and reheat flowmeter transmitters, causing the motors
R to rotate (the warning lights may come on dimly).
R When the switch is released the warning lights come
R on fully and remain on until the servo motors have
R nulled.

B. Electrical Power Supplies

Table 1 lists the services, busbars and circuit breaker panels.

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
Flow rate indicator		
No.1 engine	No.1 main 115 V a.c.	14-215
No.2 engine	No.2 main 115 V a.c.	13-215
No.3 engine	No.3 main 115 V a.c.	13-216
No.4 engine	No.4 main 115 V a.c.	14-216
Fuel consumed indicator		
No.1 engine	No.1 main 115 V a.c.	14-215
No.2 engine	No.2 main 115 V a.c.	13-215
No.3 engine	No.3 main 115 V a.c.	13-216
No.4 engine	No.4 main 115 V a.c.	14-216
Total fuel remaining indicator	No.1 main 115 V a.c.	14-215
	No.2 main 115 V a.c.	13-215
	No.3 main 115 V a.c.	13-216
	No.4 main 115 V a.c.	14-216
Flowmeter transmitter		
No.1 engine	No.1 main 115 V a.c.	14-215
No.2 engine	No.2 main 115 V a.c.	13-215
No.3 engine	No.3 main 115 V a.c.	13-216
No.4 engine	No.4 main 115 V a.c.	14-216

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
Electronic unit	No.3 main 115 V a.c.	13-216

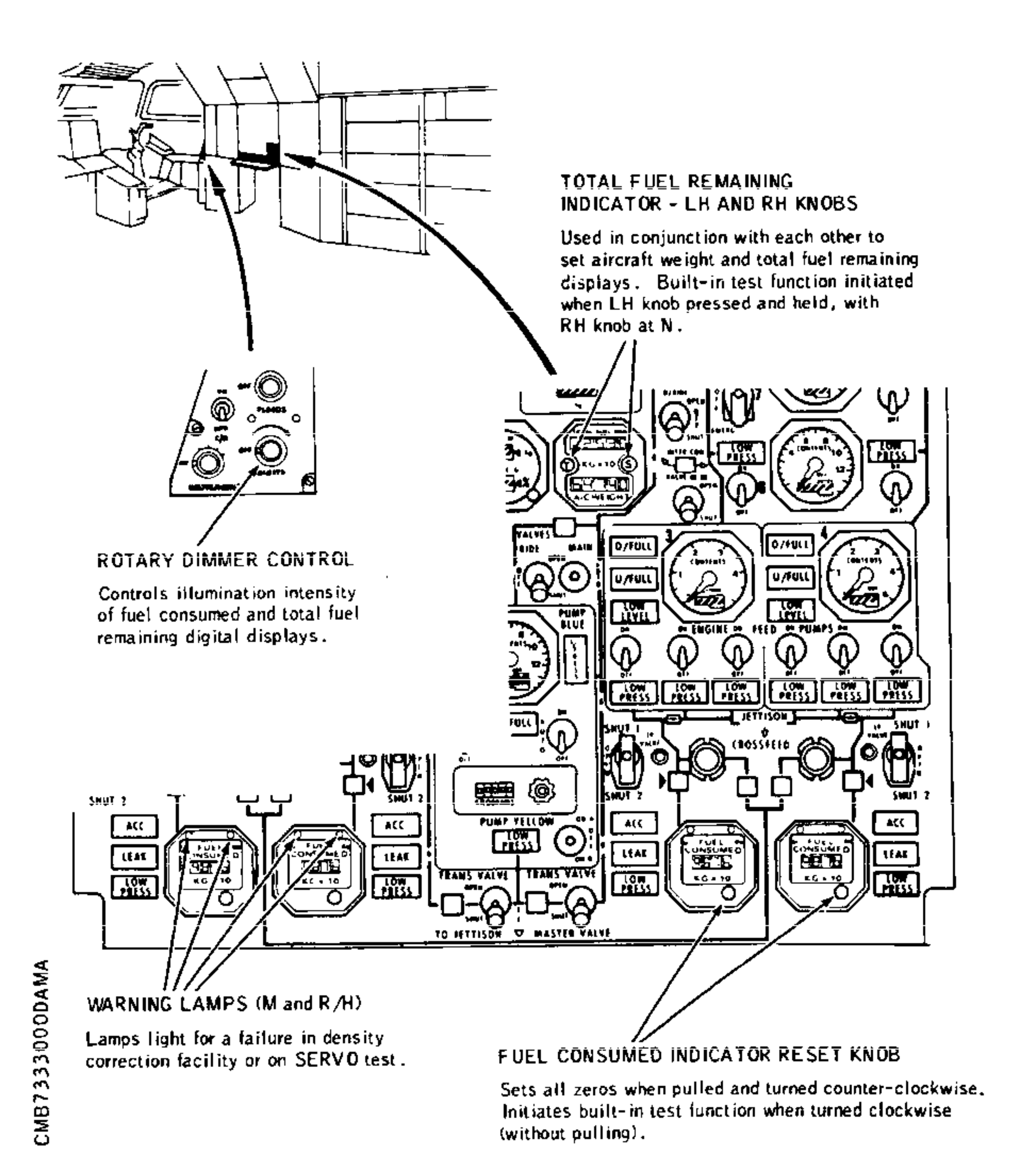
Electrical Power Supplies
Table 1

8. System Management (Ref. Fig. 004)

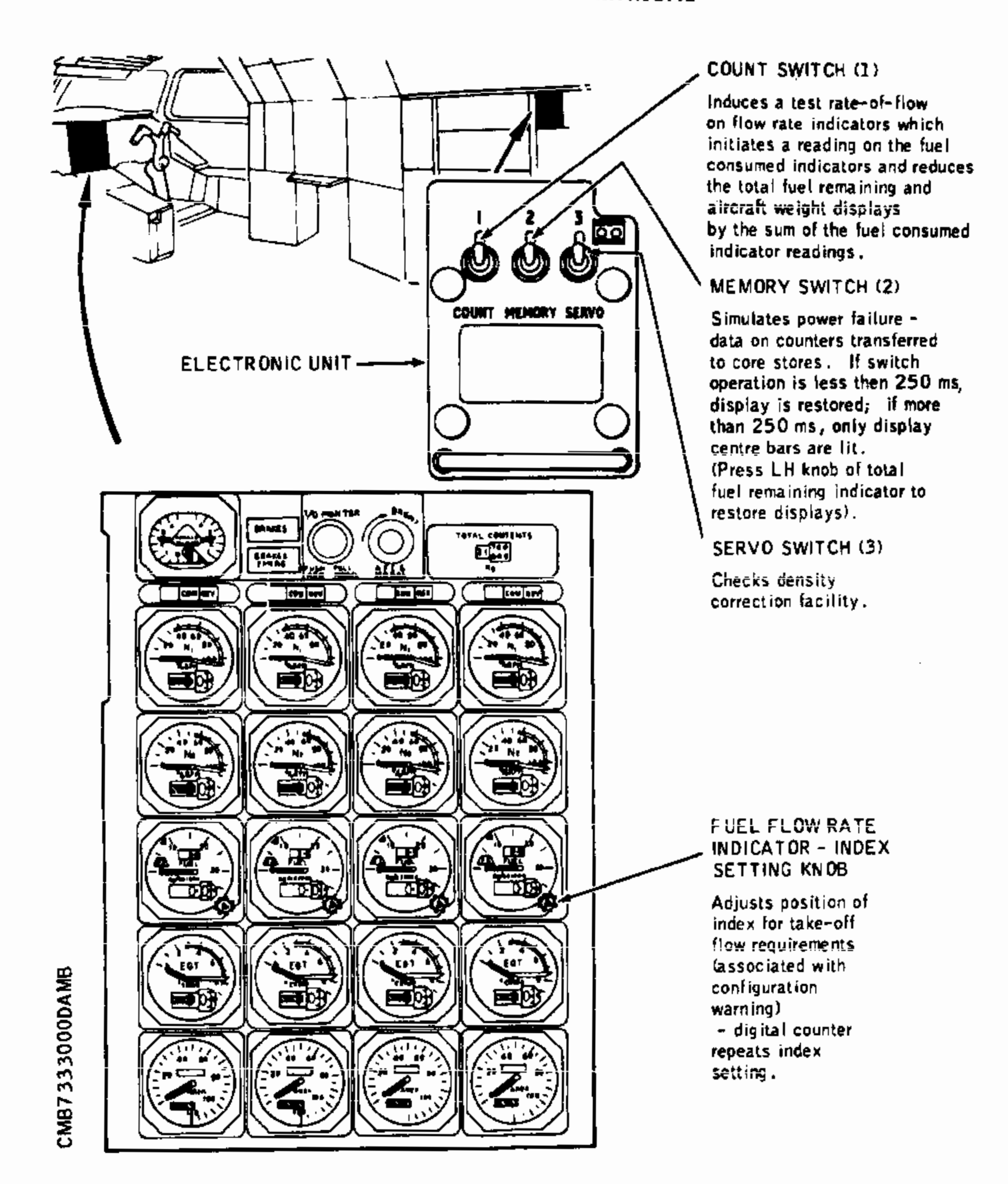
With the engines running, the fuel flow indication system measures and indicates the fuel consumed and flow rate of each engine, the total fuel remaining and aircraft weight. Before flight, the index on each flow rate indicator must be pre-set to the take-off fuel flow requirements. The fuel consumed indicators must be set to zero and the aircraft weight set on the total fuel remaining indicator. The fuel load is then set on the total fuel remaining indicator and is automatically added to the aircraft weight display.

Built-in test equipment (BITE) is provided for proving the system without engines running. Some of the BITE is incorporated in the electronic unit and controlled by switches on the front of the unit.

Electrical ground power must be connected to the aircraft for setting the indicators and for proving the integrity of the system.



\- System Management (Sheet 1 of 2)
Figure 004



- System Management (Sheet 2 of 2)
Figure 004

FUEL FLOW INDICATION - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic contains the removal/installation procedures for the potentiometer (dimmer unit) fitted on panel 11-214 at the 3CMstation in the flight compartment. The potentiometer is used for dimming the 7-bar digital displays of the fuel consumed and total fuel remaining indicators and the indicators on the FQI control panel (Ref. 28-40-00).

2. Potentiometer (Ref. Fig. 401)

A. Equipment and Materials

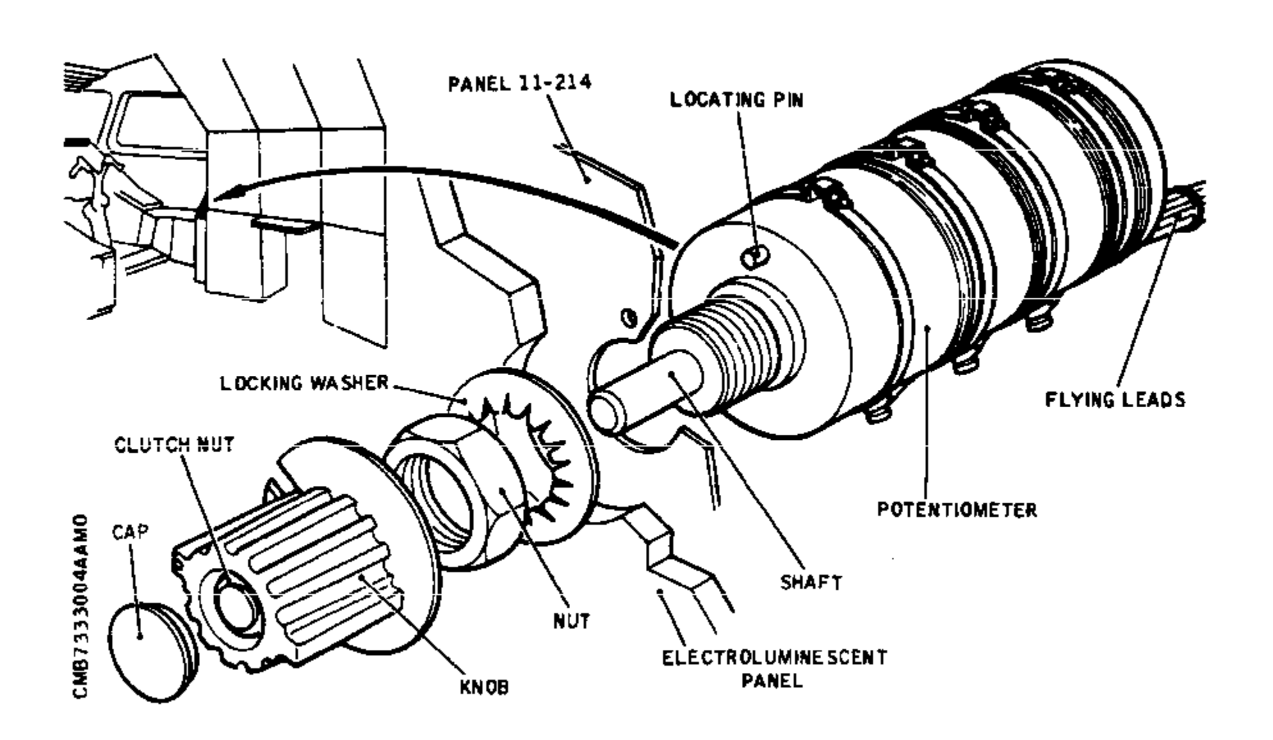
DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Electrically isolate panel 11-214 by tripping and fitting safety clips to the circuit breakers listed below.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
3CM lighting control panel			
FUEL CONSUMED TOTAL/WT IND	13-216	E473	D5
3 CM FLOOD & READING LTS SUP	1-213	L238	N22
3CM STN CB PNL LTS SUP	2-213	L87	A9
R R 3CM STN INST LTS SUP	13-216	L377	E7
3CM STN PNL LTS SUP	14-216	L86	D9

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.



- Potentiometer (Dimmer Unit) - Installation
Figure 401

C. Remove

CAUTION: ELECTROLUMINESCENT PANELS ARE VULNERABLE TO DAMAGE BY SCRATCHING AND CRACKING. OPERATORS MUST ENSURE THAT TOOLS DO NOT COME INTO CONTACT WITH, OR OTHERWISE DAMAGE, THE PANELS.

(1) Release the fasteners securing panel 11-214 to the aircraft structure and, supporting the panel, withdraw it to gain access to the rear of the panel.

(2) Disconnect the connectors at the rear of the panel and remove the panel.

(3) Release the potentiometer cables (flying leads) from the panel loom ties and, using a suitable tool, withdraw the pin inserts from the connector block.

(4) Remove the cap from the end of the knob, unscrew the clutch nut and withdraw the knob from the shaft.

CAUTION: ENSURE THAT THE TUBULAR SPANNER DOES NOT DAMAGE THE POLISHED WALL OF THE ELECTROLUMINESCENT PANEL.

(5) Using a suitable tubular spanner, remove the nut and locking washer and withdraw the potentiometer from the rear of the panel.

D. Install

(1) Comply with the electrical safety precautions.

(2) Remove the nut and spring washer (if fitted) from the potentiometer shaft.

(3) Position the potentiometer through its aperture, from the rear of the panel, ensuring that the locating pin engages in the hole in the panel.

(4) Fit the locking washer over the shaft through the front of the panel and secure the potentiometer in position with the nut.

(5) Turn the shaft of the potentiometer fully counter-clockwise to the "OFF" position. Fit the knob on the shaft with the white line on the knob in line with the OFF position; fit the clutch nut and end cap.

(6) Using a suitable tool, connect the electrical cables to the connector block, ensuring that the connections are made in accordance with the cable identification and applicable wiring diagram.

(7) Secure the electrical cables to the panel with suitable ties in accordance with the Wiring Diagram Manual, 20-41-01.

(8) Connect the electrical connectors at the rear

of the panel, position the panel and secure it with the fasteners.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Check the controls/switches and panel illumination on panel 11-214 by carrying out the appropriate test procedures.

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FUEL FLOW INDICATION - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic contains an Operational Test using the built-in test equipment (BITE), and a System Test to prove the integrity of the density correction system. A Functional Test is not considered necessary in this application. That part of the System Test under paragraph C. must be performed during an engine run (Ref. Chap.71).

2. Operational Test

NOTE: The following tests are performed without fuel flowing through the flowmeter transmitters but the transmitters must be fully primed before commencing the tests. This Operational Test does not check the operation of the helical rotors or the integrity of the pick-up coils in the transmitters; these must be checked during an engine run (Ref. Chap.71).

A. Prepare

(1) Remove the sealing cover from shelf 1-216 in the flight compartment RH racking, aft.

(2) Make available electrical ground power as detailed in 24-41-00 and check that the following requirements are met:-

(a) Only the centre bars are illuminated on all FC indicators and the TFR indicator.

(b) If the warning lights on any of the FC indicators come on, they go out within 10 s.

NOTE: If the warning lights do not come on when power is first switched on, this indicates that the servo loop in that particular channel is in the null position and should not be taken as a fault.

(c) All FFR indicators are reading zero (less than 200 kg/h), with the letters FE showing in the mode flag windows, and all power failure warning flags have disappeared from view.

(3) Operate the warning light test switch (Ref. 33-14-00)

and check that the main (M) and reheat (R/H) warning lights come on.

(4) Check that the legends and dials of the indicators are evenly illuminated (Ref. 33-17-00).

B. Test

(1) Display Restoration Test

(a) Check that the right reset knob on the TFR indicator is at position N.

(b) Press and hold the left reset knob on the TFR indicator and check that all nine digits on the indicator are displaying the figure eight.

(c) Release the knob and check that the digits on the indicator and the four FC indicators are displaying a reading other than centre bars only.

(d) Note the reading of each FC indicator.

(e) Turn the reset knob on each FC indicator clockwise in turn and hold for 5 s and check that all digits are displaying the figure eight.

(f) Check that the readings return to the same values as noted in operation (d).

NOTE: It may be observed that the warning lights come on and then go out during this test, but no conclusion should be drawn from this. The density correction integrity tests should be performed with the engines running (Ref. para.3., System Test).

(2) Aircraft Weight and Fuel Load Setting Test

(a) Turn the right knob on the TFR indicator one position from N in a counter-clockwise direction.

NOTE: This corresponds to the least significant digit in the display.

(b) Press and release the left knob and the

least significant digit will increase by one. Continue to press and release the left knob, raising the digit by one for each action until the required figure is set.

NOTE: Ignore the total fuel remaining display at this stage.

(c) Repeat the procedure for the remaining positions of the right knob, turning counter-clockwise, until the dry aircraft weight is displayed, and note the value.

(d) Turn the right knob one position from N in a counter-clockwise direction, pull the left knob firmly and check that the total fuel remaining display reads zero. Release the knob.

(e) Press and release the left knob and set a nominal fuel load on the display with the right knob in all positions in turn, commencing with the least significant digit.

(a) Operate the SERVO switch (3) on the

NOTE: The fuel weight is automatically added to the aircraft weight display. If the fourth significant digit in the total fuel remaining display is accidently set to too high a figure, continue to to press and release the left knob until the digit has travelled through zero to the correct figure. This will not invalidate the aircraft weight reading, since the display is automatically corrected.

(f) Check that the aircraft weight display now contains the total of the figure set in operations (b) and (c) and the total fuel remaining set in operation (e) as given in the following example:-

Nominal aircraft weight set in operations (b) and (c):	16,839
Fuel load (total fuel remaining) set in operation (e):	9,881
Aircraft weight now reading:	26,720

(g) Return the right knob to "N".

(3) Setting Error Correction Test

(a) Note the readings of the aircraft weight and total fuel remaining displays.

(b) Turn the right knob to the fourth position counter-clockwise from position N.

(c) Press and release the left knob ten times and check that both displays read the figure noted in operation (a).

(d) Turn the right knob to "N" and leave the display as set.

(4) Count Test

(a) Set the displays on the four FC indicators to zero, using the reset knob on the front of each unit, as follows:-

a1) Pull the knob and turn it in a counter-clockwise direction.

a2) Release the knob and check that the display reads zero in the least significant digit and the remaining digits are blank.

(b) Check that the four FFR indicators are reading zero.

(c) Operate the COUNT switch (1) on the electronic unit and hold 'on' for exactly 36 s and check that the FFR indicators are reading between 27 and 33 (x 1000) kg while the switch is depressed, and that the letters FT are showing in the mode flag windows. Note the actual FFR indicator readings.

(d) Release the switch and check that the reading on each of the four FC indicators is the same as noted in operation (c) above.

NOTE: Any discrepancy between the four readings must not exceed one least significant digit.

(e) Check that the total fuel remaining and

aircraft weight readings have decreased by the sum of the four FC indicator readings.

(f) Check that the four FFR indicators have returned to zero and the letters FE are showing in the mode flag windows.

(5) Servo Test

R NOTE: For this test, fuel must be present in the flowmeter transmitter.

(a) Operate the SERVO switch (3) on the electronic unit.

R R NOTE: The warning lights on the four FC indicators may come on dimly.

R R R (b) Release the switch after 5 to 10 s and check that the lights come on and then go off.

R R R NOTE: The delay before the lights go off is equal to the duration of the switch operation.

(6) Memory Test and Zero Blanking Check (TFR Indicator)

(a) Set the aircraft weight and total fuel remaining displays to read zero as follows:-

a1) Turn the right knob to one position counter-clockwise from position N.

a2) Press and release the left knob until the least significant digit in the aircraft weight display is zero.

a3) Repeat operation a2) for the other four positions of the right knob, turning counter-clockwise.

a4) Pull the left knob firmly, then release it. Check that all digits in both displays are zero.

a5) Turn the right knob to "N" and check that both displays go blank except the least significant digits, which should remain at zero.

(b) Flick down and immediately release the MEMORY switch (2) on the electronic unit (to simulate a power failure of less than 250 ms) and check that zeros are still displayed.

(c) Operate the MEMORY switch (2) for 5 s (to simulate a power failure of more than 250 ms), release the switch and check that only the centre bars of the displays are lit.

(d) Press and release the left knob and check that the least significant digits again read zero.

NOTE: While the knob is pressed, the displays will read all eights.

(e) Set the aircraft weight and total fuel remaining displays to read sevens as follows:-

e1) Turn the right knob one position counter-clockwise from position N.

e2) Press and release the left knob until the least significant digits in both displays read seven.

e3) Repeat for the other four positions of the right knob until all digits display seven.

e4) Turn the right knob to "N".

(f) Flick down and immediately release the MEMORY switch (2) and check that sevens are still displayed.

(g) Press and release the left knob and check that sevens disappear then reappear.

(h) Set the aircraft weight and total fuel remaining displays to read eight as follows:-

h1) Turn the right knob one position counter-clockwise from position N.

h2) Press and release the left knob once to change the least significant digit

from seven to eight.

h3) Repeat operation h2) for the other four positions of the right knob, turning counter-clockwise until all digits display figure eight.

h4) Turn the right knob to "N".

(i) Flick down and immediately release the MEMORY switch (2) and check that eights are still displayed.

(j) Operate the MEMORY switch (2) for 5 s, release it and check that only the centre bars of the displays are lit.

(k) Press and release the left knob and check that eights reappear.

(7) Memory Test and Zero Blanking Check (FC Indicators)

NOTE: The following procedure tests the core-stores in the memory circuits of the FC indicators. Each digit must be checked at 0, 7 and 8, except the most significant digit, this being checked at 0, 1 and 2 only.

(a) Set the four FC indicators to zero by pulling the left knob on each indicator and turning it counter-clockwise. Check that the three most significant digits on each indicator are blank and the least significant digit reads zero.

(b) Flick down and immediately release the MEMORY switch (2) and check that zero is still displayed on each indicator.

(c) Operate the MEMORY switch (2) for 5 s. Release the switch and check that only the centre bars of the displays are lit.

(d) With the right knob on the TFR indicator set to position N, press and release the left knob and check that zeros are again displayed on the four FC indicators.

(e) Operate the COUNT switch (1) on the electronic

unit until the indicators reach 1777 (x 10) kg.

NOTE: Any discrepancy between the four fuel consumed indicator readings must not exceed one least significant digit.

(f) Flick down and immediately release the MEMORY switch (2) and check that 1777 is still displayed on each FC indicator.

(g) Operate the MEMORY switch (2) for 5 s. Release the switch and check that only the centre bars of the displays are lit on each indicator.

(h) Press and release the left knob on the TFR indicator and check that 1777 reappears on each FC indicator.

(i) Operate the COUNT switch (1) on the electronic unit until each FC indicator reads 1888 (x 10) kg.

(j) Flick down and immediately release the MEMORY switch (2) on the electronic unit and check that 1888 is still displayed on each FC indicator.

(k) Operate the MEMORY switch (2) for 5 s. Release the switch and check that only the centre bars of the displays are lit on each indicator.

(l) Press and release the left knob on the TFR indicator and check that 1888 reappears on each FC indicator.

(m) Operate the COUNT switch (1) until each FC indicator reads 2000 (x 10) kg.

(n) Flick down and immediately release the MEMORY switch (2) and check that 2000 is still displayed on each FC indicator.

(o) Operate the MEMORY switch (2) for 5 s. Release the switch and check that only the centre bars of the displays are lit on each indicator.

(p) Press and release the left knob on the TFR indicator and check that 2000 reappears on each

FC indicator.

(8) Display Dimming Test

(a) Operate the control knob of the potentiometer (dimmer unit) on panel 11-214 throughout the full range of movement and check that the digits on the TFR indicator and FC indicators brighten and dim in accordance with the control knob movement.

(9) Fuel Flow Rate Indicator Test

(a) Test each of the FFR indicators in turn, as follows:-

a1) Rotate the index setting control and ensure that the index moves smoothly around the dial. Check that the index counters repeat the index setting.

a2) With the pointer at zero, turn the index to approximately full scale and check that the output to the configuration warning system (Ref. 77-13-00) changes state.

NOTE: The index switch changes between 32,000 and 35,000 kg.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Check that the warning flags are covering the counters of each fuel flow rate indicator.

(3) Refit and secure the sealing cover over shelf 1-216 in the RH racking, aft.

3. System Test

A. Prepare

(1) Remove the cover from shelf 1-216 in the flight compartment RH racking, aft.

(2) Make available electrical ground power as detailed in 24-41-00 and check that the following requirements are met:-

(a) Only the centre bars are illuminated on all four fuel consumed (FC) indicators and the total fuel remaining (TFR) indicator.

(b) If the warning lights on any of the FC indicators come on, they go out within 10 s.

NOTE: If the warning lights do not come on when power is first switched on, this indicates that the servo loop in that particular channel is in the null position and should not be taken as a fault.

(c) All fuel flow rate (FFR) indicators are reading zero (less than 200 kg/h), with the letters FE showing in the mode flag windows and all power failure warning flags have disappeared from view.

B. Test (Prior to Engine Start)

(1) Restore the displays on the TFR indicator and the four FC indicators, using the controls on the TFR indicator. Turn the right reset knob to "N" and operate the left reset knob as follows:-

(a) Press and hold the reset knob and check that all nine digits are displaying the figure eight.

(b) Release the reset knob and check that all nine digits and the digits on the four FC indicators are displaying a reading other than centre bars only.

(2) Note the readings of the four FC indicators and the TFR indicator. Check that the four FFR indicators are reading zero, and perform a count test as follows:-

(a) Operate the COUNT switch (1) on the electronic unit and check that all FFR indicators are reading 30,000(±10 per cent) kg/h while the switch is depressed and that the letters FT are showing in all four mode flag windows.

(b) Release the switch after 12 s and check that the following requirements are met:-

b1) The reading of each of the four FC indicators has increased from the reading noted in (2), above, by 10(±1) (x 10) kg.

b2) The total fuel remaining and aircraft weight readings on the TFR indicator have each decreased from the readings noted in (2), above, by the sum of the increases of the FC indicators noted in (2) b1), above.

b3) All FFR indicator pointers have returned to zero and the letters FE are showing in all mode flag windows.

(3) Perform a servo test as follows:-

R NOTE: For this test fuel must be present in the
R flowmeter transmitter.

R (a) Operate the SERVO switch (3) on the
R electronic unit.

R NOTE: The warning lights on the four
R FC indicators may come on dimly.

R (b) Release the switch after 5 to 10 s
R and check that the lights come on and
R then go off.

R NOTE: The delay before the lights go off
R is equal to the duration of the
R switch operation.

(4) Note the readings of the four FC indicators and the TFR indicator and perform a memory test as follows:-

(a) Flick down and release the MEMORY switch (2) on the electronic unit and check that the readings noted in (4), above, reappear.

(b) Operate the MEMORY switch and hold it for 5 s; release the switch and check that the centre bars only are illuminated on each of the five indicators.

(c) Check that the right reset knob on the TFR indicator is set to "N", press and release the left reset knob and check that the readings noted in (4), above, reappear.

(5) Set the display on each FC indicator in turn to read zero, by operating the reset knob on the front of each unit as follows:-

(a) Pull the reset knob then turn it in a counter-

clockwise direction whilst in the extended position.

(b) Release the reset knob and check that the three most significant digits are blanked and the least significant digit is reading zero.

C. Test (After Engine Start)

(1) Check that the FFR indicator associated with the engine running is showing a fuel flow rate consistent with engine data (Ref. Chap.71).

(2) Check that the associated FC indicator is counting up at the same rate as shown on the FFR indicator and the TFR indicator is counting down by the total of all FC indicators operating.

(3) Check that the main (M) and reheat (R/H) warning lights are out.

NOTE: If the warning lights are on prior to engine run, they should go out within 10 s from the engine start.

(4) Check the integrity of the density correction system in each flowmeter transmitter in turn, using the reset knob on the associated FC indicator as follows:-

(a) Turn the reset knob clockwise, hold it for 5 s and check that all digits are displaying the figure eight.

NOTE: The main (M) and reheat (R/H) warning lights may or may not come on whilst the control is being operated.

(5) Release the reset knob and check that the main and reheat warning lights come on and then go out within 10 s and that the FC indicator reverts to displaying the increasing count.

D. Conclusion

(1) After engine shut-down, switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Check that the warning flags are covering the counters of each FFR indicator.

(3) Refit and secure the sealing cover over shelf 1-216

in the RH racking, aft.

ENGINE FUEL FLOWMETER - REMOVAL/INSTALLATION

1. General

The engine flowmeter outlet flange is bolted to the front face of the fuel distribution and dump valve and the FCU fuel tube flange bolts to the flowmeter inlet flange.

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Tools and Equipment

Circuit breaker safety clip ... ... -

3. Engine Fuel Flowmeter - Removal/Installation

A. Prepare for Flowmeter Removal.

(1) Close the LP fuel isolation valve and ensure that the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.1			
	LP VALVE SUP 1	15-216	1Q1	C1
	LP VALVE SUP 2	16-215	1Q2	-
	FUEL FLOW IND SUP	14-215	E471	C15
	Engine No.2			
R	LP VALVE SUP 1	15-216	2Q1	F 2
R	LP VALVE SUP 2	15-215	2Q2	C19
	FUEL FLOW IND SUP	13-215	E472	D16
	Engine No.3			

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R LP VALVE SUP 1	15-216	3Q1	F 1
R LP VALVE SUP 2	15-215	3Q2	C20
FUEL FLOW IND SUP	13-216	E564	D4
Engine No.4			
LP VALVE SUP 1	15-216	4Q1	C2
R LP VALVE SUP 2	16-215	4Q2	-
FUEL FLOW IND SUP	14-216	E565	B3

Circuit Breakers
Table 401

(4) Drain the engine fuel flowmeter.

(a) Remove blanking ferrule assembly from tube drain point and drain fuel into a container.

(b) When fuel drain ceases, apply lubricant A to blanking ferrule assembly and assemble blank to tube drain point.

(c) Torque-tighten blank to between 190 and 210 lbf in. (21,5 and 23,5 N.m) and wire-lock it.

NOTE: Discard drained fuel or inhibiting fluid.

B. Remove Flowmeter (Ref. Fig. 401).

(1) Disconnect electrical lead end plug.

(2) Disconnect fuel tube from flowmeter.

(a) Remove the three bolts secured by nut plate assembly.

(b) Remove nut and bolt securing flowmeter flange and nut plate assembly to fuel tube flange.

(c) Remove bolts from the remaining two locations at flowmeter flange and withdraw seal plate.

CR 30472/00A

ELECTRICAL CONNECTION

ENGINE FUEL FLOWMETER

DISTRIBUTION AND DUMP VALVE

SEAL PLATE

A

SEAL PLATE

CMR 73 33 01 4 AAM0

✱ SMALL WASHER LOCATION

NUT PLATE ASSEMBLY

TUBE DRAIN POINT

B

VIEW IN DIRECTION OF ARROW B

FUEL TUBE

SEAL PLATE

\- Engine Fuel Flowmeter Attachment Details
Figure 401

NOTE: Do not remove the two nuts and bolts securing the support bracket to the tube elbow.

(3) Support flowmeter, remove bolts and flat washers securing the unit to the distribution and dump valve then remove flowmeter and seal plate from engine.

C. Install Flowmeter (Ref. Fig. 401).

R (1) Apply lubricant B to attachment items.

(2) Connect flowmeter to fuel tube.

(a) Position flowmeter on engine and carefully insert serviceable seal plate (Ref.70-00-03,Sealing
R Devices), ensuring that the flat of the plate
R is against electrical connection position and
R bolt-holes are aligned. If necessary, turn seal
R plate to reverse faces and align bolt-holes.

(b) Position nut plate assembly against flowmeter flange and secure with lightly tightened nut and bolt.

(c) Assemble three bolts through fuel tube and flowmeter flanges to engage with the three nuts of the nut plate assembly. Lightly tighten bolts.

(d) Assemble bolts at the remaining two locations and lightly tighten them.

(3) Connect flowmeter to distribution and dump valve.

R (a) Carefully insert serviceable seal plate between
R flowmeter flange and valve face.

(b) Secure the flowmeter with six bolts and flat washers. Install the two smaller diameter washers with the bolts inserted at each side of
R the protrusion on the flange as shown in the
R illustration (Ref. Fig. 401).

(4) Torque-tighten bolts to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

R (5) Connect, tighten and wire-lock electrical lead end
R plug.

R D. Check for Leaks at Connections Disturbed During Procedure.

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure ; comply with the procedures given in 73-33-01, Adjustment/Test, paragraph 2.

(b) PTIR pressure ; comply with the procedures given in 73-33-01, Adjustment/Test, paragraph 3.

(c) On completion of static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph E.

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph E.

E. Restore Engine to Flight Standard.

(1) Remove safety clips, reset circuit breakers (Ref. Table 401) and open the LP fuel isolation valve.

(2) If a leak check is to be made during an engine run, start appropriate aircraft fuel feed pumps and carry out a preliminary leak check at connections and the seal drains outlet at drains tank overflow vent. No leaks are acceptable. On completion of check, switch off the aircraft fuel feed pumps.

(3) If the fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref. 71-00-00, Servicing) that are required for the engine run checks, and comply with the procedures of 73-00-00 and 71-00-00, Adjustment/Test respectively. On completion of engine run, retrip circuit breakers and attach safety clips.

(4) Close engine bay doors (Ref. 71-00-00, Servicing).

ENGINE FUEL FLOWMETER - ADJUSTMENT/TEST

1. General

This chapter is complementary to the Removal/Installation of the engine fuel flowmeter and details the procedures for leak checks by application of a static pressure. Paragraph 2 details the leak checks using the aircraft fuel feed pumps and paragraph 3 details the leak checks using the pressure test and inhibiting rig (PTIR).

Details of approved servicing and storage materials quoted in this chapter are given in 70-00-01.

2. Leak Check With Aircraft Fuel Feed Pumps

A. General

The engine fuel flowmeter and associated connections are leak checked, using the appropriate aircraft fuel feed pump in conjunction with the procedures detailed in 73-00-00, Adjustment/Test.

B. Tools and Equipment

Pressure test equipment items (contained in adapter set
R PE.29964) are required as follows:

Blank PE.35092

Blank/bleed valve PE.35065

Blanking unit (2) AS.15826

C. Prepare to Leak Check Engine Fuel Flowmeter and Associated Connections.

(1) Electrically isolate the T1 PROBE HEATER circuit breakers (Ref. Table 501) by tripping the breaker affecting the engine upon which work is to be carried out. Attach safety clips.

WARNING: WHENEVER ENGINE HP CONTROL CIRCUIT BREAKER IS TO BE TRIPPED OR HP VALVE SWITCH IS SET TO OPEN, FIRST TRIP ASSOCIATED T1 PROBE HEATER CIRCUIT BREAKER AND PREVENT UNNECESSARY HEATER OPERATION. HEATER(S) WOULD BE SWITCHED ON AND ATTAIN OPERATING TEMPERATURE WITHIN 30 SECONDS OF HP VALVE SWITCH OR CIRCUIT BREAKER OPERATION.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF
Engine No.1			
T1 PROBE HTR SUP	13-215	1H542	C9
Engine No.2			
T1 PROBE HTR SUP	14-215	2H542	E8
Engine No.3			

(2) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.B., as detailed for the installation and removal of the following items of test equipment and engine components respectively.

(a) AS.15826 - blanking unit (Ref. Fig. 501) (detail F). Install a blanking unit on each of the fuel atomizing pilot nozzle tube junction connections.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 502). Install items in outlet connections of distribution and dump valve.

(3) Direct free ends of drain tubes into a container.

(4) Detach seal failure drains system tubes at distribution and dump valve to provide a more precise check for leaks (Ref. Fig. 502).

D. Leak Check Engine Fuel Flowmeter and Associated Connections.

(1) Pressurize and leak check the system between the HP shut-off valve and the distribution and dump valve outlet connections.

(a) Remove the safety clips and reset circuit breakers (Ref.73-33-01, Removal/Installation, Table 401).

(b) Ensure that all fuel connections are secure, open the LP fuel isolation valve and start the appropriate aircraft fuel feed pumps.

(c) Select the HP VALVE switch OPEN and energize

the start solenoid valve.

(d) Bleed air from the system by means of the bleed valve in the blank/bleed valve installed in the distribution and dump valve drain outlet.

(e) When system is free of air close valve and check system for signs of leakage. No leaks are acceptable.

(2) On completion of check, switch off pumps.

(a) Select HP VALVE switch to SHUT.

(b) Switch off the aircraft fuel feed pumps.

(3) If a seal failure drains connection leakage should occur:

(a) Establish the location of the defective seal by reference to paragraph 3.G.

(b) Renew a defective seal or component and then repeat the leak check.

E. Remove Pressure Test Equipment and Install/Connect Engine Components.

(1) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.D., as detailed for the removal and installation of the following items of test equipment and engine components respectively.

(a) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

(b) PE.35092 - blank and PE.35065 - blank/bleed valve. Remove test blanking units and install flight standard blanking ferrules in tube connections.

R (2) Remove safety clip and reset circuit breaker
R (Ref. Table 501).

3. Leak Check Using PTIR

A. General

This paragraph details the procedure for a pressure test and leak check using the PTIR and pressure test equipment.

On completion of the PTIR checks a final leak check is required using the aircraft fuel feed pumps to check remade connections after removal of test equipment.

B. Tools and Equipment.

Pressure test and inhibiting rig (PTIR) PE.17988

Pressure test equipment (contained in adapter set PE.29964) are required as follows:

Air bleed tube	PE.22898
Adapter (Pre S.B.OL.593-73-1 drain valve)	PE.22972
Adapter (S.B.OL.593-73-1 drain valve) ...	PE.26710
Blank	PE.20757
Blank	PE.35092
Blank/bleed valve	PE.35065
Blanking unit (2)	AS.15826
Blanking plug	PE.29937
Clamp	PE.27277
Drain adapter	PE.20748
Drain adapter	PE.35666
Hose	PE.22893
Hose	PE.28394
Drain tube (Pre S.B.OL.593-73-1 drain valve) ...	PE.34076
Drain tube (S.B.OL.593-73-1 drain valve)	PE.26796

C. Test Fluid

Aviation Kerosine D.Eng.R.D.2494
or
Inhibiting fluid DEF.2001A
or
D.Eng.R.D.2490

D. Drain the Inlet Section of the System.

CR 31229/0013

CLAMP

BLANK

FUEL INLET ELBOW

A

B

A

DRAIN VALVE

INLET ELBOW DRAIN ADAPTER

ADAPTER SB.73-1

COVER

HOSE ASSEMBLY

SEALING RING

ADAPTER PRE SB.73-1

THROTTLE VALVE ACTUATOR GEARBOX

DRAIN ADAPTER ASSEMBLY (INCORPORATING RELIEF VALVE)

B

CMR 73 33 01 5 AAMA

Installation of Test Equipment
and Location (Sheet 1 of 2)
Figure 501

CR 31449/00C

E

F

EJECTOR PUMP OUTLET

BLANKING PLUG

FIRST STAGE PUMP

E

BLANKING PLUG

FUEL ATOMIZING PILOT NOZZLE TUBE JUNCTION

F

BLANKING PLUG

CMR 73 33 01 5 AAMB

Installation of Test Equipment and Location (Sheet 2 of 2)
Figure 501

(1) Open the bleed valve to expedite draining.

(2) Use drain tool PE.34076 (Pre S.B.OL.593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve. Direct free end of drain tube into a container and drain the system upstream of the fuel heater and filter.

(3) When drain ceases, remove the drain tube and close the bleed valve.

(4) Discard drained fuel or inhibiting fluid.

E. Install Pressure Test Equipment.

(1) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.B., as detailed for the installation and removal of the following items of test equipment and engine components respectively.

(a) PE.20757 - blank and PE.27277 - clamp (Ref. Fig. 501) (detail A). Install in fuel inlet elbow.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B. OL.593-73-1 drain valve) or PE.26710 adapter (S.B.OL.593-73-1 drain valve) (Ref. Fig. 501) (detail A). Assemble hose and adapter to fuel inlet elbow drain valve location.

(c) PE.29937 - blanking plug (Ref. Fig. 501) (detail E). Install in the return fuel tube at outlet to ejector pump/first stage pump.

(d) PE.35666 - drain adapter (Ref. Fig. 501) (detail B). Install adapter in the throttle valve actuator gearbox spill/drain plug location.

(e) PE.20748 - drain adapter (Ref. Fig. 501) (detail A). Assemble drain adapter to fuel inlet elbow drain connection.

(f) AS.15826 - blanking unit (Ref. Fig. 501) (detail F). Install items on fuel atomizing pilot nozzle tube junction connections.

(g) PE.28394 - hose (Ref. Fig. 502). Connect to connection on servo fuel tube near connection to distribution and dump valve.

CR 31471/00R

COOLING FUEL TUBE

A

SERVO FUEL TUBE

DISTRIBUTION AND
DUMP VALVE

HOSE ASSEMBLY

BLANK

BLANK BLEED
VALVE

A

SEAL DRAINS TUBES

CMR 73 33 01 5 BAMO

Distribution and Dump Valve - Installation
of Test Equipment and Seal Drains Location
Figure 502

(h) PE.35092 - blank and PE.35065 - blank/bleed valve (Ref. Fig. 502). Install items in fuel outlet connections of distribution and dump valve.

(2) Direct free ends of drain tubes into a container.

F. Pressure Test Procedure.

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple the two self-sealing hoses of the test rig to the installed test adapter hoses at the inlet elbow and the servo fuel tube.

(c) Verify that the weight of each hose is supported and that all connections are secure before commencing test procedure.

(d) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence the test procedure.

(2) Bleed all air from the system and continue with the low pressure test, paragraph (3).

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

(b) Install air bleed tube PE.22898, open the air bleed valve and allow to bleed until an air free fuel flow is obtained and then close the valve. Allow a short settling period and repeat the bleed process to ensure that the second stage pump region is air free and again close the valve and remove air bleed tube.

(c) Open bleed valve of manifold blank/bleed valve and allow to bleed until an air free flow is again obtained and then close bleed valve.

(3) Carry out the low pressure test.

(a) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage, and ensure that the following conditions are met before commencing the high pressure test.

(a1) No leakage from the primary static seals is acceptable. If a leak shows from the disconnected outlets of the seal failure drains system, find defective seal(s) by a process of elimination (Ref. para.G.).

NOTE: A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

(a2) There should be no spill from the actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

(4) Continue with a high pressure test.

(a) Operate the test rig and increase the test pressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check the disconnected seal failure drains connections for signs of leaks. No leaks are acceptable. If a leak is disclosed, find defective seal(s) by a process of elimination (Ref.para.G.).

NOTE: The seal drains connections at the distribution and dump valve and fuel inlet elbow are interconnected internally to more than one seal.

(d) If spill from actuator gearbox appears excessive (100 cc/min. maximum acceptable limit) carry out an accurate leak rate check as specified in 73-00-00, Adjustment/Test.

(e) Reduce test pressure to zero and stop pump motor.

(5) On completion of pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hoses. Open the bleed valves to expedite draining.

CAUTION: ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED. FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

G. Procedure to Locate and Rectify a Leak.

(1) Should a leak from a seal be disclosed, locate the defect and rectify it by renewal of seal plate or component. Refer to 73-11-01, Adjustment/Test to identify seals connected to fuel inlet elbow drains connection. The distribution and dump valve seal failure drains outlet connects internally to the following seals.

(a) FCU to distribution and dump valve rear face fuel servo spill tube seal.

(b) FCU to distribution and dump valve fuel servo tube seal.

(c) FCU fuel tube union to distribution and dump valve rear face fuel servo spill tube seal.

(d) Thermometer unit face seal.

(e) Upper fuel manifold connection to distribution block and dump valve seal.

(f) Lower fuel manifold connection to distribution and dump valve seal.

(g) Engine fuel flowmeter fuel inlet connection seal.

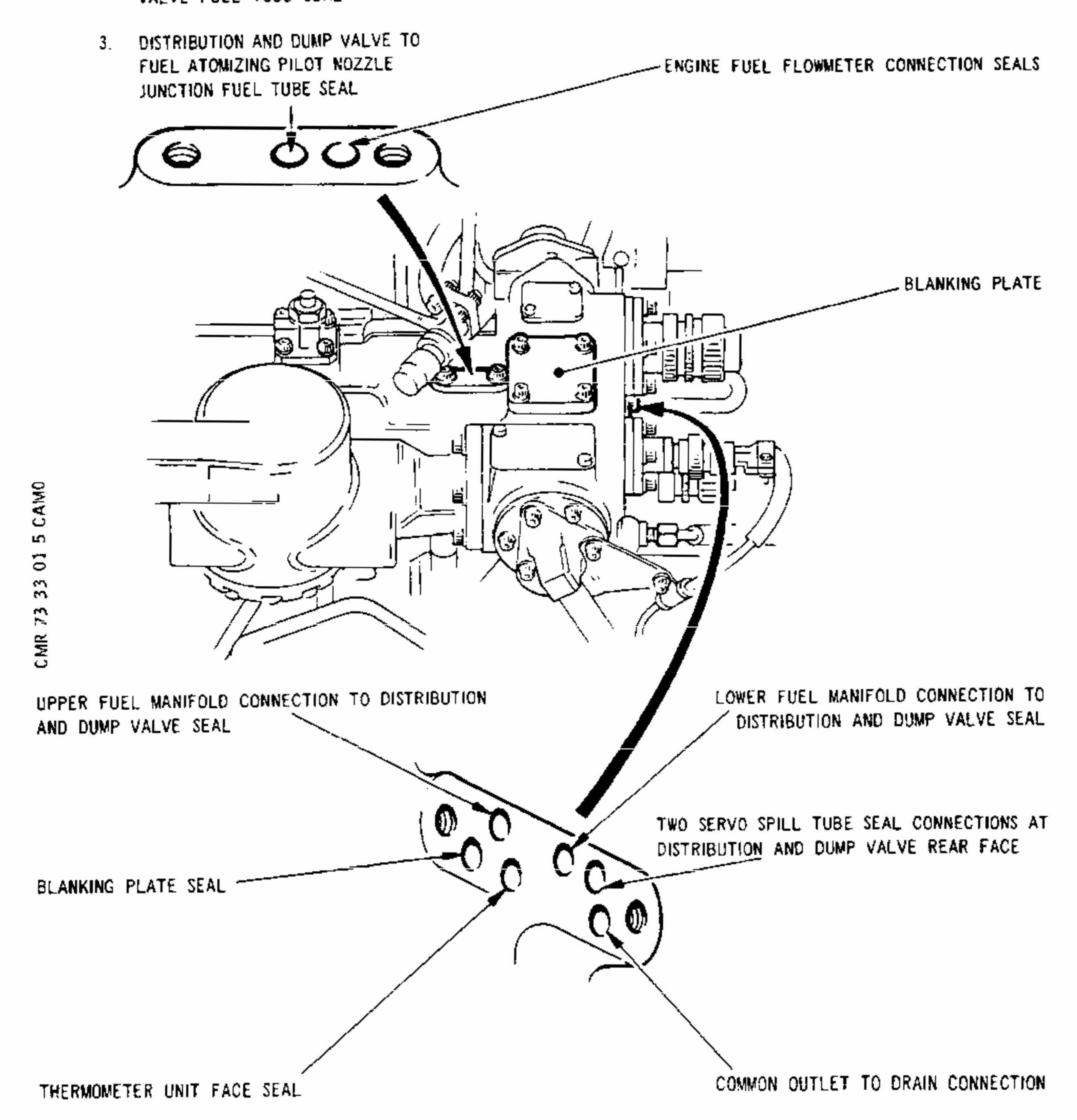
(h) Engine fuel flowmeter fuel outlet connection seal.

(j) Starter pump to distribution and dump valve fuel tube seal.

(k) Distribution and dump valve to fuel atomizing pilot nozzle tube seal.

(l) Blanking plate seal.

(2) The following procedures will enable defective item to be identified (Ref. Fig. 503).



Distribution and Dump Valve Seal Failure
Drains Transfer Passages and Outlets
Figure 503

(a) Remove each drain duct cover plate, in turn, and determine (with test pressure applied) from which individual ports the fuel leakage occurs. Install the cover after each check. Establish the location of the defective seal by reference to the illustration.

(b) Release test pressure.

(c) Renew a defective seal or component and then repeat the pressure test and leak check.

H. Remove Test Equipment and Install/Connect Engine Components.

(1) Carry out the procedures of 73-00-00, Adjustment/Test, paragraph 6.D., as detailed for the removal and installation of the following items of test equipment and engine components respectively.

NOTE: If an engine is to be inhibited, refer to 70-00-07, Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

(a) PE.20757 - blank and PE.27277 - clamp ring. Remove blank and clamp ring and reconnect the aircraft/engine main fuel connection.

(b) PE.22893 - hose and PE.22972 - adapter (Pre S.B. OL.593-73-1 drain valve) or PE.26710 - adapter (S.B.OL.593-73-1 drain valve). Remove hose and adapter and install drain valve.

(c) PE.29937 - blanking plug. Remove plug and install blanking ferrule at ejector pump.

(d) PE.35666 - drain adapter. Remove adapter and install the blanking plug in the actuator gear-box.

(e) AS.15826 - blanking units. Remove blanks and connect fuel atomizing pilot nozzle tubes to the tube junction.

(f) PE.28394 - hose. Detach hose adapter and install blanking ferrule to connection on servo fuel tube.

(g) PE.35092 - blank and PE.35065 - blank/bleed val-ve. Remove test blanking units and install flight

standard blanking ferrules in tube connections.

(2) Carry out a final leak check.

(a) Remove the safety clips and reset circuit breakers (Ref.73-33-01, Removal/Installation, Table 401).

(b) Ensure that all fuel connections are secure, open the LP fuel valve and start the appropriate aircraft fuel feed pumps.

(c) Install air bleed tube PE.22898, open the air bleed valve and bleed all air from the system. When fuel flows free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valves, blanking ferrules and the drains outlets of the aircraft/engine connections under test. No leaks are acceptable.

NOTE: The manifold flight standard blanking ferrules cannot be leak checked using aircraft feed pump pressure.

(e) On completion of check, switch off the aircraft feed pumps.

(3) PE.20748 - drain adapter. Remove drain adapter from inlet elbow and connect the seal drains system as detailed in 73-00-00, Adjustment/Test, paragraph 6.D.

(4) Ensure that seal is in place and assemble the dust cap to the air bleed valve. Tighten the cap and wire-lock it.

(5) Assemble pressure cap with new seal to the fuel inlet elbow drain valve. Tighten the cap and wire-lock it.

(6) Complete the procedure as detailed in 73-33-01, Removal/Installation.

REHEAT FUEL FLOWMETER - REMOVAL/INSTALLATION

R 1. General

R Details of approved servicing and storage materials quoted
R in this chapter are given in 70-00-01.

R 2. Tools and Equipment

Air bleed tube	PE.22898
Drain tube (Pre S.B.OL.593-73-1 drain valve)	PE.34076
R Drain tube (S.B.OL.593-73-1 drain valve) ...	PE.26796
Circuit breaker safety clip	-

R 3. Reheat Fuel Flowmeter - Removal/Installation

A. Prepare for Flowmeter Removal.

R (1) Close the LP fuel isolation valve and ensure that
R the valve indicator shows shut.

(2) Open engine bay front lower door (Ref.71-00-00, Servicing).

(3) Electrically isolate the engine additional services indicated in Table 401 by tripping the circuit breakers affecting the engine upon which work is to be carried out. Attach safety clips.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	Engine No.1			
R	LP VALVE SUP 1	15-216	1Q1	C1
R	LP VALVE SUP 2	16-215	1Q2	-
R	FUEL FLOW IND SUP	14-215	E471	C15
	Engine No.2			
R	LP VALVE SUP 1	15-216	2Q1	F2
R	LP VALVE SUP 2	15-215	2Q2	C19
R	FUEL FLOW IND SUP	13-215	E472	D16
	Engine No.3			

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R	LP VALVE SUP 1	15-216	3Q1	F1
R	LP VALVE SUP 2	15-215	3Q2	C20
R	FUEL FLOW IND SUP	13-216	E564	D4
	Engine No.4			
	LP VALVE SUP 1	15-216	4Q1	C2
R	LP VALVE SUP 2	16-215	4Q2	-
R	FUEL FLOW IND SUP	14-216	E565	B3

Circuit Breakers
Table 401

(4) Drain the engine fuel system.

(a) Open bleed valve to expedite draining.

R (b) Use drain tube PE.34076 (Pre S.B.OL.593-73-1 drain valve) or PE.26796 (S.B.OL.593-73-1 drain valve) at the inlet elbow drain valve and drain tube PE.21970 at the fuel heater and filter drain valve. Direct free ends of drain tubes into a container and drain the system upstream of the FCU.

R (c) When fuel drain ceases, remove the drain tubes and close the bleed valve.

(5) Drain the reheat fuel flowmeter.

(a) Remove the blanking ferrule from the flowmeter fuel inlet tube filter blanking plate and drain the fuel into a drainage container.

(b) Apply lubricant A to blanking ferrule assembly.

(c) When fuel drain ceases, assemble ferrule to blanking plate and torque-tighten it to between 190 and 210 lbf in. (21,5 and 23,5 N.m) and wire-lock it.

NOTE: Discard drained fuel or inhibiting fluid.

(6) Support oil tank vent tube seal plate, remove attach-

ment nuts and bolts and remove seal plate.

(7) Unscrew fluid passage bolt securing multiple connector near flowmeter inlet and detach seal failure drains system.

B. Remove Flowmeter (Ref. Fig. 401).

R (1) Disconnect electrical lead end plug.

(2) Disconnect fuel tube from flowmeter.

(a) Remove the three bolts secured by nut plate assembly.

(b) Remove nut and bolt securing flowmeter flange and nut plate assembly to fuel tube flange.

(c) Remove bolts from the remaining two locations at fuel tube flange and withdraw seal plate.

(3) Support flowmeter, remove bolts and flat washers securing the unit to the reheat fuel controller elbow then remove flowmeter and seal plate from engine.

C. Install Flowmeter (Ref. Fig. 401).

(1) Connect flowmeter to fuel tube.

R (a) Apply lubricant B to attachment items.

(b) Position flowmeter on engine and carefully
R insert serviceable seal plate (Ref.70-00-03,
R Sealing Devices), ensuring that the flat of
R the plate is against the electrical connection
R position and bolt holes are aligned. If
R necessary, turn seal plate to reverse faces and
R align bolt holes.

(c) Assemble the two short bolts at the threaded hole locations and lightly tighten.

(d) Position nut plate assembly against flowmeter flange and secure at plain hole position with nut and bolt lightly tightened.

(e) Assemble three bolts through fuel tube and flowmeter flanges to engage with the three nuts of the nut plate assembly. Lightly tighten bolts.

CR 31056/00A

A

ATTACHMENT BOLTS

REHEAT FUEL FLOWMETER

SEAL PLATE

ELECTRICAL CONNECTION

SEAL FAILURE DRAINS SYSTEM
FLUID PASSAGE BOLT

NUT PLATE ASSEMBLY

A

VIEW IN DIRECTION
OF ARROW B

REHEAT FUEL CONTROLLER
INLET ELBOW

SEAL PLATE

FUEL TUBE

B

SEAL PLATE

✳ SMALL WASHER LOCATION

CMR 73 33 02 4 AAM0

\- Reheat Fuel Flowmeter Attachment Details
Figure 401

(2) Connect flowmeter to reheat fuel controller elbow.

(a) Apply lubricant B to attachment items.

R (b) Carefully insert serviceable seal plate (Ref.
R 70-00-03, Sealing Devices) between flowmeter
R flange and reheat fuel controller elbow.

(c) Install and lightly tighten the six bolts, nuts and washers securing the flanges, positioning the two smaller diameter washers under heads of bolts at each side of the protrusion on the flange (Ref. Fig. 401).

(3) Torque-tighten nuts and bolts at both flanges to between 67 and 73 lbf in. (7,6 and 8,2 N.m).

(4) Connect tighten and wire-lock the electrical lead end plug.

D. Check for Leaks at Connections Disturbed During Procedure.

(1) If a static pressure test for fuel leaks is to be carried out, use either the aircraft fuel feed pumps or the pressure test and inhibiting rig (PTIR).

(a) Feed pump pressure - comply with the procedures given in 73-33-02, Adjustment/Test, paragraph 2.

(b) PTIR pressure - comply with the procedures given in 73-33-02, Adjustment/Test, paragraph 3.

(c) On completion of static pressure test and removal of any installed test equipment, continue with the installation procedure of paragraph E.

(2) If a leak check is to be carried out during an engine run, continue with the installation procedure of paragraph E.

E. Complete the Installation

(1) If a leak check is to be made during an engine run carry out a preliminary leak check using the aircraft fuel feed pumps.

(a) Remove safety clips, reset circuit breakers (Ref. Table 401) and open the LP fuel isolation valve.

(b) Install air bleed tube PE.22898, start

appropriate aircraft fuel feed pumps and bleed all air from the system.

(c) When fuel flow free of air, close the bleed valve and torque-tighten to between 100 and 110 lbf in. (11,3 and 12,4 N.m) with lubricant A applied. Remove bleed tube.

(d) Check for signs of leakage at bleed valve, drain valves and seal drains outlet at drains tank overflow vent. No leaks are acceptable.

(e) On completion of check, switch off the aircraft fuel feed pumps.

(2) To complete the installation or prepare for ground
R run, reconnect the seal failure drains system and
R install the bleed and drain valve caps.

R (a) Apply lubricant A to fluid passage bolt and
R install connector with a new seal washer on
R each side and secure with bolt. Torque-
R tighten passage bolt to between 150 and 170
R lbf in. (16,9 and 19,2 N.m).

R (b) Ensure that seal is in place and assemble the dust cap to air bleed valve. Tighten and wire-lock the cap.

R (c) Assemble pressure caps with new seals to the filter and heater unit and fuel inlet elbow drain valve. Tighten and wire-lock each cap.

R (d) Apply lubricant A, then assemble seal plate
R to manifold elbow with three bolts and nuts
R torque-tightened to between 85 and 95 lbf in
R (9,6 and 10,7 N.m). Wire-lock connections.

R (e) Remove safety clips, reset circuit breakers
R (Ref. Table 401), and open the LP fuel
R isolation valve.

R (3) If the fuel system leak check is to be carried out in conjunction with an engine run, reset the circuit breakers tripped for the opening of the engine bay doors (Ref. 71-00-00, Servicing) that are required for the engine run checks and comply with the procedures of 73-00-00 and 71-00-00, Adjustment/Test respectively. On completion of engine run, retrip circuit breakers and attach safety clips.

R (4) Close engine bay doors (Ref. 71-00-00, Servicing).

REHEAT FUEL FLOWMETER - ADJUSTMENT/TEST

R 1. General

R This chapter is complementary to the Removal/Installation of
R the reheat fuel flowmeter and details the procedures for leak
R checks by application of a static pressure. Paragraph 2
R details the leak checks using the aircraft fuel feed pumps
R and paragraph 3 details the leak checks using the pressure
R test and inhibiting rig (PTIR).

R Details of approved servicing and storage materials quoted in
R this chapter are given in 70-00-01.

R 2. Leak Check with Aircraft Fuel Feed Pumps

R A. General

R The reheat fuel flowmeter and associated connections are
R leak checked, using the appropriate aircraft fuel feed
R pump, in conjunction with the procedures detailed in
R 73-00-00, Adjustment/Test.

R B. Tools and Equipment

R Air Bleed Tube PE.22898

R C. Leak Check Reheat Fuel Flowmeter and Associated
R Connections.

R (1) Ensure that drains tubes at reheat fuel flowmeter
R seal failure drains connection are detached for leak
R checks (Ref. 73-33-02, Removal/Installation).

R (2) Apply static pressure and check for leaks.

R (a) Remove the safety clips and reset circuit
R breakers (Ref. 73-33-02, Removal/Installation
R Table 401).

R (b) Ensure that all fuel connections are secure,
R open the LP fuel valve and start the appropriate
R aircraft fuel feed pumps.

R (c) Install air bleed tube PE.22898, open the air
R bleed valve and bleed all air from the system.
R When fuel flows free of air, close the bleed
R valve and torque-tighten to between 100 and
R 110 lbf in (11.3 and 12,4 N.m) with lubricant
R A applied. Remove Bleed tube.

(d) With feed pump pressure applied, check for signs of leakage at bleed valve, drain valves, blanking ferrules and the drains outlets of the aircraft/ engine connections under test. No leaks are acceptable.

(e) On completion of check, switch off the aircraft feed pumps.

(3) If a seal failure drains connection leakage should occur it would indicate a defective seal at the flowmeter fuel inlet or outlet connection.

(a) Establish the location of the defective seal by a process of elimination.

(b) Renew a defective seal or component and then repeat the leak check.

3. Leak Check Using PTIR

A. General.

This paragraph details the procedure for a pressure test and leak check using the PTIR and pressure test equipment. On completion of the PTIR checks a final leak check is required on an engine using the aircraft fuel feed pumps to check remade connections after removal of test equipment.

B. Tools and Equipment.

Pressure test and inhibiting rig (PTIR)... ... PE.17988

Pressure test equipment items (contained in adapter set
R PE.29964) are required as follows:

Air bleed tube	PE.22898
Adapter(Pre.S.B.OL.593-73-1 drain valve)...	PE.22972
Adapter (S.B.OL.593-73-1 drain valve) ...	PE.26710
Blank	PE.20757
Blanking unit (2)	AS.15826
Blanking plug	PE.29937
Clamp	PE.27277

	Drain adapter	PE.20748
R	Drain adapter	PE.35666
	Hose...	PE.22893

R C. Test Fluid

R	Aviation kerosine	D.Eng.R.D.2494
R	or	
R	Inhibiting fluid	DEF.2001A
R		or
R		D.Eng.R.D.2490

R D. Install Press Test Equipment.

R (1) Carry out the procedures of 73-00-00, Adjustment/
R Test, paragraph 6.B. as detailed for the installation
R and removal of the following items of test equipment
R and engine components respectively.

R (a) PE.20757 - blank and PE.27277 - clamp
R (Ref. Fig. 501) (detail A). Install in fuel
R inlet elbow.

R (b) PE.22893 - hose and PE.22972 - adapter (Pre.S.B.
R OL.593-73-1 drain valve) or PE.26710 - adapter
R (S.B.OL593-73-1 drain valve) (Ref. Fig. 501)
R (detail A). Assemble hose and adapter to fuel
R inlet elbow drain valve location.

R (c) PE.29937 - blanking plug (Ref. Fig. 501)
R (detail E). Install in the return fuel tube
R at outlet to ejector punp/first stage pump.

R (d) PE.35666 - drain adapter (Ref. Fig. 501)
R (detail B). Install in the throttle valve
R actuator gearbox spill/drain plug location.

R (e) PE.20748 - drain adapter (Ref. Fig. 501)
R (detail A). Assemble drain adapter to fuel
R inlet elbow drain connection.

R (f) AS.15826 - blanking unit (Ref. Fig. 501)
R (detail F). Install items on fuel atomizing
R pilot nozzle tube junction connections.

R (2) Direct free ends of tubes into a container.

R E. Pressure Test Procedure.

CR 31229/00B

CLAMP
BLANK
FUEL INLET ELBOW
A
B
A
DRAIN VALVE
INLET ELBOW DRAIN ADAPTER
ADAPTER SB.73-1
COVER
HOSE ASSEMBLY
SEALING RING
ADAPTER PRE SB.73-1
THROTTLE VALVE ACTUATOR GEARBOX
DRAIN ADAPTER ASSEMBLY (INCORPORATING RELIEF VALVE)
B

CMR 73 33 02 5 AAMA

Installation of Test Equipment and Location
(Sheet 1 of 2)
Figure 501

CR 31449/00C

EJECTOR PUMP OUTLET

BLANKING PLUG

FIRST STAGE PUMP

E

BLANKING PLUG

FUEL ATOMIZING PILOT
NOZZLE TUBE JUNCTION

F

BLANKING PLUG

CMR 73 33 02 5 AAMB

Installation of Test Equipment and Location
(Sheet 2 of 2)
Figure 501

(1) Comply with the following general procedure for a pressure test.

(a) Prepare and use the PTIR for the test sequence to be employed in accordance with its general procedure and safety precautions.

(b) Couple a self sealing hose of the test rig to the installed test adapter hose at the inlet elbow.

(c) Verify that the weight of the hose is supported and that all connections are secure before commencing test procedure.

(d) Apply pressure slowly and progressively during the test procedure and maintain constant observation for signs of fuel leaks from test equipment or engine fuel system. Should a leak develop, reduce the pressure to zero and stop the pump motor, rectify the fault and recommence the test procedure.

(2) Bleed all air from the system and continue with the low pressure test, paragraph (3).

(a) Operate the test rig and apply a pressure of 30 psig (207 kPa).

(b) Install air bleed tube PE.22898, open the air bleed valve and allow to bleed until an air free fuel flow is obtained and then close the valve. Remove air bleed tube.

(3) Carry out the low pressure test.

(a) Continue to apply pressure at 30 psig (207 kPa) and complete the low pressure test. Check drains for indication of seal leakage and ensure that the following conditions are met before commencing the high pressure test.

R (a1) No leakage from the primary static seals is acceptable. If a leak shows from the disconnected outlets of the seal failure drains system, find defective seals by a process of elimination.

<u>NOTE:</u> A leak from the fuel inlet elbow drain could be indicative of a defective seal in the inlet elbow blank.

R (a2) There should be no spill from the throttle actuator gearbox rear face drain adapter since the relief valve setting of the adapter is higher than the applied pressure.

(4) Continue with a high pressure test.

(a) Operate the test rig and increase the test Pressure to 600 psig (4137 kPa).

(b) Apply pressure for at least five minutes and carry out a general external visual examination of the system while continuing to apply pressure. No leaks are acceptable.

(c) Continue to apply pressure and check the disconnected seal failure drains connections for signs of leaks. No leaks are acceptable. If a leak is disclosed find defective seal(s) by a process of elemination (Ref. para.E).

NOTE: The seal drains connections at the reheat fuel flowmeter and inlet elbow are interconnected internally to more then one seal.

(d) If spill from actuator gearbox adapter appears excessive (100 cc/min. maximum acceptable limit) carry out an accurate leak rate check as specified in 73-00-00 Adjustment/Test.

(e) Reduce test pressure to zero and stop pump motor.

(5) On completion of pressure test, drain the fuel system using the test rig facilities and then uncouple the delivery hose. Open the bleed valve to expedite draining.

CAUTION: ENSURE THAT AIR BLEED TUBE IS NOT INSTALLED. FOREIGN PARTICLES COULD BE DRAWN INTO ENGINE FUEL SYSTEM.

E. Procedure to Locate and Rectify a Leak.

(1) A reheat fuel flowmeter seal failure drains connection would indicate a defective seal at the flowmeter fuel inlet or outlet connection.

(a) Establish the location of the defective seal(s) by a process of elimination.

R (b) Renew a defective seal or component and then
R repeat the pressure test and leak check.

R G. Remove Test Equipment and Install/Connect Engine Components.

R (1) Carry out the procedures of 73-00-00, Adjustment/
R Test, paragraph 6.D. as detailed for the removal and
R installation of the following items of test equipment
R and engine components respectively.

<u>NOTE</u>: If an engine is to be inhibited, refer to 70-00-07, Inhibiting and Storage and ascertain which items of the installed test equipment will be required for the inhibiting procedure.

R (a) PE.20757 - blank and PE.27277 - clamp ring.
R Remove blank and clamp ring and reconnect the
R aircraft/engine main fuel connection.

R (b) PE.22893 - hose and PE.22972 - adapter (Pre.
R S.B.OL.593-73-1 drain valve) or PE.26710 -
R adapter (S.B.OL.593-73-1 drain valve). Remove
R hose and adapter and install drain valve.

R (c) PE.29937 - blanking plug. Remove plug and
R install blanking ferrule at ejector pump.

R (d) PE.35666 - drain adapter. Remove adapter and
R install the blanking plug in the actuator gear-
R box.

R (e) AS.15826 - blanking units. Remove blanks and
R connect fuel atomizing pilot nozzle tubes to
R the tube junction.

R (2) Carry out a final leak check. Comply with
R procedure detailed in paragraph 2.C.(2).

R (3) PE.20748 - drain adapter. Remove drain adapter
R from inlet elbow and connect the seal drains system
R as detailed in 73-00-00, Adjustment/Test,
R paragraph 6.D.

(4) Complete the procedure as detailed in 73-33-02, Removal/Installation.

FLOW RATE INDICATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The flow rate indicators are mounted on the pilots' centre instrument panel 6-211. As the indicators are identical, the removal/installation instructions detailed for one indicator are applicable to all four, the reference to No.1, 2, 3 or 4 being for the indicator in a particular engine (1, 2, 3 or 4) system.

2. Flow Rate Indicator

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Electrically isolate the indicator to be removed by tripping the circuit breakers for the associated circuit and fit safety clips.

R **ON A/C 006-007,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 FUEL FLOW IND SUP	14-215	E471	C15
ENG 2 FUEL FLOW IND SUP	13-215	E472	D16
ENG 3 FUEL FLOW IND SUP	13-216	E564	D4
ENG 4 FUEL FLOW IND SUP	14-216	E565	B3

Printed in England

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FUEL CONSUMED TOTAL/ WT IND	13-216	E473	D5
CTR DASH & G/SHIELD INST LTS SUP	14-216	L375	D10
FLIGHT DATA REC SUP	2-213	R205	G19
ENG 1 PP MGT LTS SUP	5-213	1E461	D1
ENG 2 PP MGT LTS SUP	1-213	2E461	E3
ENG 3 PP MGT LTS SUP	1-213	3E461	E4
ENG 4 PP MGT LTS SUP	5-213	4E461	D2

**ON A/C 001-005,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 FUEL FLOW IND SUP	14-215	E471	C15
ENG 2 FUEL FLOW IND SUP	13-215	E472	D16
ENG 3 FUEL FLOW IND SUP	13-216	E564	D4
ENG 4 FUEL FLOW IND SUP	14-216	E565	B3
FUEL CONSUMED TOTAL/ WT IND	13-216	E473	D5
CTR DASH & G/SHIELD INST LTS SUP	14-216	L375	D10
AIDS SUP	2-213	R262	G19
ENG 1 PP MGT LTS SUP	5-213	1E461	D1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 2 PP MGT LTS SUP	1-213	2E461	E3
ENG 3 PP MGT LTS SUP	1-213	3E461	E4
ENG 4 PP MGT LTS SUP	5-213	4E461	D2

C. Remove

NOTE: The electrical connector at the rear of the indicator is spring-loaded, exerting a forward pressure of approximately 10 lbf (4.536 kgf) on the indicator.

(1) Hold the face of the indicator firmly toward the instrument panel.

(2) Loosen the adapter plate securing screws; with the adapter still firmly held toward the panel, remove the screws and adapter plate.

(3) Gradually release the pressure on the indicator, which will then be forced approximately 0.5 in (12 mm) out of its panel aperture by spring pressure.

(4) Carefully withdraw the indicator from the panel.

NOTE: The indicator must be supported throughout this operation to allow for the extra weight when the electrical connector and mounting spigot disengage.

D. Install

(1) Comply with the electrical safety precautions.

(2) Check that the electrical connectors on the indicator and panel are clean and undamaged.

(3) Carefully position the indicator in the panel aperture.

(4) Align the indicator case horizontally and engage the mounting spigot.

(5) Position the adapter plate on the indicator face and engage the connector; gently but firmly press the indicator fully into engagement.

(6) Maintain the pressure on the indicator and secure the adapter plate with the screws.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Perform an Operational Test of the indicator (Ref. Adjustment/Test).

Printed in England

FLOW RATE INDICATOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic contains an Operational Test of the fuel flow rate indicator, using the built-in test equipment (BITE).

Functional and System Tests are not considered necessary in this application.

2. Operational Test

A. Prepare

(1) Remove the sealing cover, if necessary, from shelf 1-216 in the RH racking, aft.

(2) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) Check the indicator integral lighting (Ref. 33-17-00).

(2) Check that the indicator reads zero and that the mode flag is displaying FE.

(3) Operate the COUNT switch (1) on the electronic unit, fitted on shelf 1-216, and check that the flow rate indicator reads 30,000(±200) kg/h and that the mode flag is displaying FT.

NOTE: When running up from 0 to 30,000 kg/h, the failure warning flag may appear momentarily but will clear.

(4) Release the COUNT switch (1) and check that the indicator reads zero and that the mode flag reverts to FE.

(5) Rotate the index setting knob and check that the index bug moves around the dial scale and that the counter repeats the index setting.

NOTE: With the fuel flow rate indicator at zero, and the index bug set to

R approximately full scale (32,000 to
R 35,000 kg/h) a differential switch
R is actuated. This switch provides
R a test facility for the power plant
R configuration indication system.

C. Conclusion

R (1) Perform a Functional Test of the power plant
R configuration indication as detailed in
R 77-13-00, Adjustment/Test, para.2.

R (2) Refit and secure the sealing cover over shelf
1-216 in the RH racking, aft.

FUEL CONSUMED INDICATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The fuel consumed indicators are mounted on the lower fuel management panel 5-214. As the indicators are identical, the removal/installation instructions detailed for one indicator are applicable to all four, the references to Nos.1, 2, 3 or 4 being for the indicator in a particular engine (1, 2, 3 or 4) system.

Indicator Pinlites can be renewed, if necessary, without removing the indicator.

2. Fuel Consumed Indicator

A. Prepare to Remove Indicator

RB CAUTION: THERE IS A CROSS CONNECTION POSSIBILITY WHEN WORKING
RB WITH THIS COMPONENT. CLEARLY IDENTIFY CONNECTIONS ON
RB DISCONNECTION AND FUNCTION CHECK UPON RECONNECTION.

(1) Isolate the electrical generation and external power equipment as detailed in 24-00-00, Servicing.

B. Remove Indicator

(1) Gain access to the rear of the lower fuel management panel (5-214) by releasing the quick-release fasteners and pressing the spring retaining clip at each side of the panel, then lower the panel on its hinges.

(2) Disconnect the electrical connector from the appropriate indicator.

(3) Close the panel and secure it temporarily with the quick-release fasteners.

(4) Slacken the indicator clamp adjusting screws at the front of the panel, to permit the indicator to be withdrawn.

(5) Withdraw the indicator from the panel.

C. Install Indicator

(1) Comply with the electrical safety precautions.

(2) Slide the indicator carefully into its panel aperture and ensure that the spigot on the end of the instrument case has engaged correctly in the supporting lug on the cable carrier. If necessary lower the panel to verify this action.

(3) With the indicator dial aligned correctly, torque-tighten the indicator clamp securing screws to between 5 and 8 lbf in (0.0565 and 0.0904 mdaN).

(4) Lower the panel and connect the electrical connector to the indicator, ensuring that the mating surfaces are clean and undamaged.

(5) Close panel 5-214 and secure it with the quick-release fasteners.

D. Conclusion

(1) Cancel the electrical safety precautions taken in operation A.(1).

(2) Perform an Operational Test of the indicator (Ref. Adjustment/Test).

3. <u>Pinlite</u>

A. Equipment and Materials

DESCRIPTION	PART NO.
Pinlite extractor tool	3595LMT (Smiths)
Circuit breaker safety clip	-

B. Prepare to Remove Pinlite

(1) Electrically isolate the Pinlites of the indicator by tripping the circuit breakers for the associated circuit and power supplies listed below. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 FUEL FLOW IND SUP	14-215	E 471	C15
ENG 2 FUEL FLOW IND SUP	13-215	E 472	D16
ENG 3 FUEL FLOW IND SUP	13-216	E 564	D 4
ENG 4 FUEL FLOW IND SUP	14-216	E 565	B 3
FUEL CONSUMED TOTAL WT/IND	13-216	E 473	D 5
FQI CONT PNL WARN & FUEL FLOW TEST SUP	1-213	Q1407	J17

C. Remove Pinlite

(1) Slacken the screws securing the bezel to the front of the indicator case and remove the bezel, complete with screws and washers.

(2) Using the extractor tool, remove the defective Pinlite.

D. Install Pinlite

(1) Insert the Pinlite pins into the socket through the aperture in the front of the indicator case, ensuring that the mating surfaces are clean and undamaged.

(2) Position the bezel on the front of the indicator case and secure it with the screws.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Perform an Operational Test of the indicator (Ref. Adjustment/Test).

FUEL CONSUMED INDICATOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic contains an Operational Test of the fuel consumed indicator, using the built-in test equipment (BITE). Functional and System Tests are not considered necessary in this application.

2. Operational Test

A. Prepare

(1) Remove the sealing cover, if necessary, from shelf 1-216 in the RH racking, aft.

(2) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) Check the integral lighting and warning lights (Ref. 33-17-00 and 33-14-00).

(2) Carry out the following checks on the appropriate indicator:

R (a) On the total fuel remaining indicator, press
R and release the left reset knob with the
R right reset knob at N and note the reading
R on the fuel consumed indicator.

R (b) Pull the test knob on the indicator and turn it counter-clockwise, then check that the three most significant digits are blanked and the least significant digit is reading zero.

R (c) Release the test knob and check that the display does not change.

R (d) Turn the test knob clockwise and check that the display changes to all eights and that the main (M) and reheat (R/H) warning lights do not come on.

R (e) Release the test knob and check that the display returns to zero and the main and reheat warning lights briefly come on.

NOTE: With the fuel at mid-range density and at mid-range temperature, without engine vibration, the lights may not come on.

(f) Operate the COUNT switch (1) on the electronic unit, on shelf 1-216, for 12 s and check that the flow rate indicator reads 30 (x1000) kg/h and that the fuel consumed indicator reading increases.

(g) Release the COUNT switch, after 12 s, and check that the reading on the fuel consumed indicator has increased by between 9 and 10 (x10) kg. Note the reading.

(h) Operate the MEMORY switch (2), on the electronic unit on shelf 1-216, momentarily (less than 0.25 s), and check that the reading noted in operation (g), above, reappears.

NOTE: If the MEMORY switch is held longer than 0.25 s, only the centre bars will be illuminated when the switch is released. To restore the reading noted in operation (g), perform operation (a), above, and repeat operation (h) until a satisfactory result is obtained.

(i) Operate the SERVO switch (3) on the electronic unit on shelf 1-216 and check that the main (M) and reheat (R/H) warning lights come on; release the switch and check that, after a short delay, the warning lights go out.

(j) Repeat operation (b) and check that the indicator display resets to zero.

C. Conclusion

(1) Refit and secure the sealing cover over shelf 1-216 in the RH racking, aft.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

TOTAL FUEL REMAINING INDICATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The total fuel remaining indicator is mounted on the fuel management panel 5-214.

Indicator Pinlites can be renewed, if necessary, without removing the indicator.

2. Total Fuel Remaining Indicator

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-

B. Prepare to Remove Indicator

(1) Electrically isolate the indicator by tripping and fitting safety clips to the circuit breakers listed below.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	ENG 1 FUEL FLOW IND SUP	14-215	E471	C15
R	ENG 2 FUEL FLOW IND SUP	13-215	E472	D16
	ENG 3 FUEL FLOW IND SUP	13-216	E564	D4
	ENG 4 FUEL FLOW IND SUP	14-216	E565	B3
	FUEL CONSUMED TOTAL WT/IND	13-216	E473	D5
R	3CM STN INST LTS SUP	13-216	L377	E7

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.

(2) Isolate the electrical generation and external power equipment as detailed in 24-00-00, Servicing.

R C. Remove Indicator

(1) Gain access to the rear of the lower fuel management panel (5-214) by releasing the quick-release fasteners and pressing the spring retaining clip at each side of the panel, then lower the panel on its hinges.

(2) Disconnect the electrical connector from the total fuel remaining indicator.

(3) Close and secure panel 5-214.

(4) Slacken the indicator clamp adjusting screws, at the front of the panel, to permit the indicator to be withdrawn.

(5) Withdraw the indicator from the panel.

R D. Install Indicator

(1) Comply with the electrical safety precautions.

(2) Slide the indicator into the panel aperture and indicator clamp, correctly align the indicator dial and torque-tighten the clamp adjusting screws to between 5 and 8 lbf in (0.0565 and 0.0904 mdaN).

(3) Lower panel 5-214 and connect the electrical connector to the indicator, ensuring that the mating surfaces are clean and undamaged.

(4) Close panel 5-214 and secure it with the quick-release fasteners.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Cancel the electrical safety precautions taken in operation B.(2).

(3) Perform an Operational Test (Ref. Adjustment/Test).

3. Pinlite

A. Equipment and Materials

DESCRIPTION	PART NO.
Pinlite extractor tool	3595LMT (Smiths)
Circuit breaker safety clip	-

B. Prepare to Remove Pinlite

(1) Electrically isolate the Pinlites of the indicators by tripping and fitting safety clips to the circuit breakers listed below.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 FUEL FLOW IND SUP	14-215	E471	C15
R ENG 2 FUEL FLOW IND SUP	13-215	E472	D16
ENG 3 FUEL FLOW IND SUP	13-216	E564	D4
ENG 4 FUEL FLOW IND SUP	14-216	E565	B3
FUEL CONSUMED TOTAL WT/IND	13-216	E473	D5
FQI CONT PNL WARN & FUEL FLOW TEST SUP	1-213	Q1407	J17

C. Remove Pinlite

R (1) Slacken the screw at the centre of the bezel and the captive screws securing the bezel to the front of the indicator case and remove the two halves of the bezel, complete with screws and washers.

R (2) Using the extractor tool, remove the defective Pinlite.

R D. Install Pinlite

R (1) Insert the Pinlite pins into the socket through the aperture in the front of the indicator case, ensuring that the mating surfaces are clean and undamaged.

R (2) Position the two halves of the bezel on the front of the indicator case and secure them with the screws; tighten the screw in the centre of the bezel, ensuring that the washer is located beneath the head of the screw and the bezel.

R E. Conclusion

R (1) Remove the safety clips and reset the circuit breakers tripped before removal.

R (2) Perform an Operational Test of the indicator (Ref. Adjustment/Test).

TOTAL FUEL REMAINING INDICATOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic contains an Operational Test of the total fuel remaining indicator, using built-in test equipment (BITE).

Functional and System Tests are not considered necessary in this application.

2. Operational Test

A. Prepare

(1) Remove the sealing cover, if necessary, from shelf 1-216 in the flight compartment RH racking, aft.

(2) Make available electrical ground power as detailed in 24-41-00.

NOTE: The centre bars only of the 7-bar digit displays on the four fuel consumed and total fuel remaining and aircraft weight indicators are lit when aircraft power is first switched on.

(3) Restore the displays to the indicators by pressing and releasing the left reset knob with the right reset knob at N, and note the values displayed.

B. Test

(1) Display Restoration and Integrity Tests

(a) Check that the right reset knob is at N.

(b) Press and hold the left reset knob and check that, whilst the knob is held in, all nine digits on the total fuel remaining indicator are displaying the figure eight.

(c) Release the reset knob and check that the displays on the total fuel remaining indicator and the four fuel consumed indicators return to the values noted in operation A.(3).

(2) Setting Test

(a) Aircraft Weight Setting

a1) Turn the right reset knob one position from N in a counter-clockwise direction.

NOTE: This corresponds to the least significant digit in the display.

a2) Press and release the left reset knob and the least significant digit will increase by one.

a3) Continue to press and release the left reset knob, raising the digit by one for each action, until the required figure is set.

NOTE: Ignore the total fuel remaining display at this stage.

a4) Repeat the procedure for the remaining positions of the right reset knob until the aircraft weight is displayed.

(b) Fuel Load (Total Fuel Remaining) Setting

b1) Turn the right reset knob one position from N in a counter-clockwise direction. Pull the left reset knob firmly and check that the total fuel remaining display reads zero. Release the knob.

b2) Press and release the left reset knob and check that the least significant digit in the total fuel remaining indicator display increases by one.

NOTE: The aircraft weight display also increases as the fuel load setting is increased.

b3) Continue to press and release the left reset knob until the required figure is set in the least significant digit of the total fuel remaining display.

b4) Turn the right reset knob counter-clockwise to the next three positions in turn, operating the left reset knob at each position until the required figures are set on the total fuel remaining display.

NOTE: If the resetting sequence is followed correctly, any mistake made in resetting a particular digit will have no effect on the final result, if that digit is finally set to the correct number.

b5) Check that the aircraft weight display now indicates the total of the aircraft weight and total fuel remaining set above.

(3) Setting Error Correction Test

(a) Note the readings of both aircraft weight and total fuel remaining displays.

(b) Turn the right reset knob to the fourth position past N in a counter-clockwise direction, press and release the left reset knob ten times, then check that both readings are as noted in operation (a), above.

(c) Turn the right reset knob to N and leave the display as set.

(4) Count Test

(a) Note the readings of the four fuel consumed indicators and total fuel remaining indicator. Check that the four flow rate indicators are reading zero.

(b) Operate the COUNT switch (1) on the electronic unit for 12 s and check that while the switch is on the flow rate indicators read 30,000 (±10 per cent) kg/h and the mode flags display FT.

(c) Release the COUNT switch (1), after 12 s, and check that the four fuel consumed indicator readings have increased, from the note taken in operation (a), above, by between 9 and 10 (x10) kg and that the total fuel remaining and aircraft weight indicator readings have both decreased by the sum of the four fuel consumed indicator readings.

NOTE: Any discrepancy between the four fuel consumed indicator readings must not exceed one least significant digit.

(d) Check that the four flow rate indicators are reading zero and that the mode flags are displaying FE.

(5) Memory Test

(a) Note the readings of the four fuel consumed indicators and the total fuel remaining indicator.

(b) Operate, and immediately release, the MEMORY switch (2) (to simulate a power failure of less than 250 ms) and check that the readings noted in operation (a), above, reappear.

(c) Operate the MEMORY switch (2) for 5 s. Release the switch and check that only the centre bars of the displays are lit.

(d) Check that the right reset knob on the total fuel remaining indicator is set to N, then press and release the left reset knob and check that the readings noted in operation (a) reappear.

NOTE: This test only checks the memory circuits of the digits displayed. For a complete Memory Test, refer to 73-33-00, Adjustment/Test.

C. Conclusion

(1) Refit and secure the sealing cover over shelf 1-216 in the flight compartment RH racking, aft.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

ELECTRONIC UNIT - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The electronic unit is contained in a double Elfin case located on shelf 1-216 in the flight compartment RH racking.

2. Electronic Unit

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-

B. Prepare

(1) Electrically isolate the indicator by tripping and fitting safety clips to the circuit breakers listed below.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 FUEL FLOW IND SUP	14-215	E471	C15
R ENG 2 FUEL FLOW IND SUP	13-215	E472	D16
ENG 3 FUEL FLOW IND SUP	13-216	E564	D4
ENG 4 FUEL FLOW IND SUP	14-216	E565	B3
FUEL CONSUMED TOTAL WT/IND	13-216	E473	D5
FQI CONT PNL WARN & FUEL FLOW TEST SUP	1-213	Q1407	J17

(2) Remove the sealing cover from shelf 1-216 in the RH racking, aft, and identify the unit to be removed.

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C. Remove

(1) Loosen the knurled securing screws.

(2) Grasp the carrying handle and carefully withdraw the electronic unit from the backplate connector then remove the unit from the shelf.

D. Install

(1) Comply with the electrical safety precautions.

(2) Check that the mating surfaces of the electrical connector are clean and undamaged.

(3) Slide the unit into the shelf and carefully engage the electrical connector.

(4) Complete the installation by tightening the securing screws; check that the unit is correctly bonded in accordance with 20-27-11.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Perform an Operational Test (Ref. Adjustment/Test).

ELECTRONIC UNIT - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic contains an Operational Test of the electronic unit, using the built-in test equipment (BITE).

Functional and System Tests are not considered necessary in this application.

2. Operational Test

A. Prepare

(1) Remove the sealing cover, if necessary, from shelf 1-216 in the flight compartment RH racking, aft.

(2) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) Count Test

(a) Note the values of the total fuel remaining and aircraft weight indicator displays.

R (b) Operate the COUNT switch (1) on the electronic
R unit for 36 s; check that the fuel flow rate
R indicators for engines 1, 2, 3 and 4 each read
R 30(±4) kg/h x 1,000, with the FT flags displayed,
R and the fuel consumed indicator displays for
R engines 1, 2, 3 and 4 each increase by 30(±4).

R NOTE: Whatever fuel flow rate is indicated, the
R fuel consumed indicator will count, e.g.,
R flow rate 27 kg/h x 1,000, fuel consumed
R 27 x 10 kg.

R (c) Check that the total fuel remaining and aircraft
R weight displays both decrease by the sum of the
R fuel consumed indicators simultaneously.

(2) Memory Test

(a) Note the values of the four fuel consumed indicators and total fuel remaining and aircraft weight indicator displays.

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(b) Operate the MEMORY switch (2) on the electronic unit for 3 s and check that the fuel consumed and total fuel remaining/aircraft weight indicator displays blank out.

(c) Release the MEMORY switch (2) and check that only the centre bars of the digital indicators are showing.

(d) With the test knob S, on the total fuel remaining indicator, on NORM, press and hold the test knob T and check that the total fuel remaining and aircraft weight displays show all eights. Check that the four fuel consumed indicator displays revert to their original values noted in operation (a) above.

(e) Release the test knob T and check that the total fuel remaining and aircraft weight indicator displays revert to their original values noted in operation (a) above.

(3) Servo Test

NOTE: For this test, fuel must be present in the flowmeter transmitter.

(a) Operate the SERVO switch (3) on the electronic unit.

NOTE: The warning lights on the four FC indicators may come on dimly.

(b) Release the switch after 5 to 10 s and check that the lights come on and then go off.

NOTE: The delay before the lights go off is equal to the duration of the switch operation.

(4) Repetitive Memory Test

(a) Note the values of the four fuel consumed indicators and total fuel remaining and aircraft weight indicator displays.

(b) Operate the MEMORY switch (2) on the electronic unit, momentarily, and check that all fuel consumed indicators and total fuel remaining and aircraft weight indicator displays remain

unchanged.

(c) With the test knob S, on the total fuel remaining indicator, on NORM, press and hold the test knob T and check that the total fuel remaining and aircraft weight indicator displays show all eights. Check that the four fuel consumed indicator displays revert to their original values noted in operation (a) above.

(d) Release the test knob T and check that the total fuel remaining and aircraft weight indicator displays revert to their original values noted in operation (a) above.

C. Conclusion

(1) Refit and secure the sealing cover over shelf 1-216 in the flight compartment RH racking, aft.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

END OF THIS SECTION

NEXT